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A PILGRIMAGE TO TEOTIHUACAN.

BY R. E. HILLS.

THE pyramids of Teotihuacan are situated in a beautiful valley adjoining that of Mexico on the Northeast, and possessing greater beauty and fertility than its more famous neighbor. To reach these ruins, we left the city by the six o'clock morning train, for the station of San Juan Teotihuacan. Our party consisted of four Americans, one a resident of Mexico. As the sun had not risen, we found the air chilly and penetrating, and overcoats very comfortable. Our leader prudently carried an umbrella, not to keep off the rain, for it never rains here in March, but to protect himself from the fierce rays of the sun, which in the clear atmosphere of this altitude are very effective at midday.

About eight o'clock we alight from the train to be besieged by numerous small boys, who offer for sale various relics from the ruins. After engaging the services of four Indian boys as guides, we set off afoot to visit the ruins.

Accounts differ as to the origin of these works. We are informed by Ixtlilxochitl that they were built by the Toltecs after their migration from Hue Hue Hapalan.

Mr. Bancroft places this event in the fifth or sixth century, Professor Short thinks that the evidence in favor of the fourth century is fully as good. On the other hand, Mons. Charnay's recent excavations have led him to believe that the works at Tula were built about A. D. 660, and as the Teotihuacan works are of very much the same character, and at no great distance from Tula, the presumption is that their age is about the same.

In selecting their site, the builders certainly exercised better

judgment than did the later race, who built the wonderful city on the shore of Lake Tezcuco—a lake whose only outlet is the atmosphere. In fact, the government has finally been compelled to attempt the artificial drainage of this lake; a contract for the construction of a canal for this purpose having been already made.

The principal works at Teotihuacan consist of two truncated pyramids—the "Mound of the Sun" and the "Mound of the Moon." The first measures 761 by 722 feet at the base, 216 feet in height, and its platform measures 59 by 105 feet, according to the figures of Señor Garcia y Cubas.

From a distance a zigzag pathway leading up its eastern side is plainly discernible, but from either its foot or its summit the pathway is not noticed. In the centre of the platform stands a pillar of stone and cement, five feet in diameter, and four and a half feet high. Two explanations of this pillar may be offered. In case the pyramid was a religious structure, the pillar may have been used as an altar, or a pedestal for some sculptured image. If the pyramid was an astronomical structure, a possibility by no means remote when we remember the knowledge of astronomy possessed by this race, the pillar was doubtless a part of the apparatus employed in observing the movements of the heavenly bodies.

From this summit we look to the north and see a series of beautifully rounded hills which look as if they might have been made by the hand of man, so regular are their outlines. To the west is the hill which hides from our view the lovely valley of Mexico.

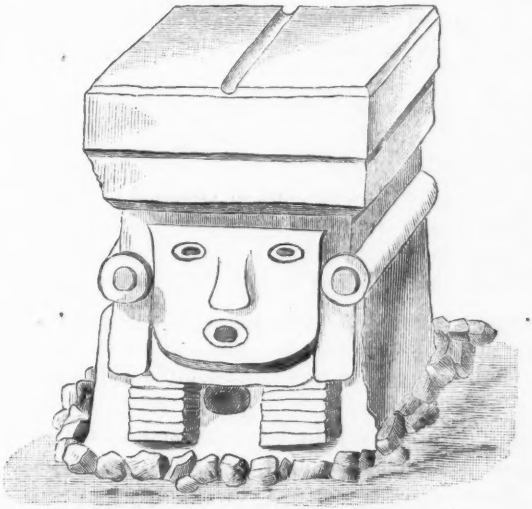
In the distance, toward the south, are the white peaks of Popocatapetl, Ixtacihuatl and Malinche, while at our feet we may see the villages of San Juan, San Sebastian, San Martin and Santa Maria, so near that we can catch the sound of their bells as they ring out from the white tower of the Spanish-built churches.

The "Mound of the Moon," according to our former authority, measures 512 by 426 feet at the base, 137 feet in height, and has a platform 19½ feet square. In addition there is a step or platform about half way from base to summit. From near this mound extends an avenue between two rows of singular ruins to the Rio San Juan, a distance of more than a mile. This is called the "Path of the Dead," and passes by the "Mound of the Sun" on the west. These ruins have the appearance of immense houses which have been totally destroyed, leaving only great masses of

material with no recognizable structure, and now largely overgrown with vegetation.

The pyramids themselves are very regular in shape, but are covered with loose fragments of volcanic rock varying in size from six to eighteen inches. Amongst these rocks have grown up numerous shrubs, flowers and cactuses. These give a very ragged appearance to the structures.

Near the "Path of the Dead" is the mouth of a cave of unknown depth, which has ramifications to the right and left. There



Monolith near the Pyramids of Teotihuacan.

is a tradition that a subterranean passage exists between the pyramids. If this is true the cave is probably connected with this passage. As our party had not prepared to explore any caves our investigations ceased when we had exhausted the stock of wax matches we happened to have in our pockets. At the mouth of this cave stands the huge monolith described by Almaraz (Apuntes, pp. 354–5), which he says "was found among the débris of a tlaltel" or mound. It is about five and a half feet wide and thick, and according to the above author, ten and a half feet high, and weighs over fifteen tons. At present, however, it stands only six feet above ground, and is surrounded by the small volcanic rocks which cover the surface in all directions. An at-

tempt was once made to remove the monolith to the city of Mexico, but it was found too heavy and was abandoned. The natives relate that soon after the conquest, the Spaniards attempted to cut the stone in two, but after each day's work with chisels, the stone was miraculously restored in the night to a perfect condition, and they finally desisted. The accompanying cut shows the face of the stone as it now appears.

Near the "Mound of the Sun" may be seen the ruins of the "Palace." Its present magnificence consists in a solid floor of cement, some smoothly plastered walls about three feet in height built at an angle of perhaps fifteen degrees from the vertical, and a stairway of six or seven stone steps leading down into the débris.

In the ploughed fields in this vicinity we found large numbers of obsidian implements and terra-cotta figures. The arrow-heads are exactly similar in shape and size to those made of flint, by the North American Indians, and of common occurrence.

The knife-blades are from one and one-half to one and three-fourths inches long, from three-eighths to five-eighths of an inch wide and only one-eighth of an inch thick in the center.

One figure apparently represents a horned animal, and is the only one of the kind which has come under the writer's observation. It measures one and three-fourths inches in length and the same in height, from tip to tip. In the group of terra-cotta figures, two have a decidedly Egyptian appearance, while one is as certainly African, and another shows a strong suspicion of the Turk. Many of the figures of heads seem to be wanting the left ear; whether it was purposely omitted or has been easily knocked off in consequence of having been molded separately and afterward attached to the head, it is difficult to determine. Two images represent the heads of animals, while another is a perforated disc, one and three-sixteenths inches in diameter, and half an inch thick, with a depression on one side eleven-sixteenths of an inch in diameter. There is a great variety of countenance exhibited on these figures. The material also seems to vary, to a certain extent, some of the clay being of a finer grain than the rest, and, therefore, susceptible of a smoother finish.

In regard to the ruins in general, Bancroft says, "Humboldt speaks of hundreds of these mounds" (such as compose the 'Path of the Dead") "arranged in streets, running exactly east

and west, and north and south from the pyramids." "According to Latrobe, the mounds extend for miles towards Tezcuco; and Waddy Thompson is confident that they are the ruins of an ancient city nearly as large as Mexico"

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THE GRAY RABBIT (LEPUS SYLVATICUS).

BY SAMUEL LOCKWOOD.

(Continued from November number.)

THE thrifty house-dame, who has a way of "culling simples" for her cuisine and leech-craft, feels badly hurt when the spring discloses the fact that of her savory pot-herbs the finest tussock has been used by a rabbit as a form through the winter, and the whole middle of it has been killed by the heat of the occupant's body. In a friend's garden a large mat of thyme was thus nearly ruined. Who has not heard of improvident humans eating themselves out of house and home? What self-possession and decorous restraint in this our little solitaire. However pinching the winter's cold and scarce the food, Coney keeps a wise care for his covert from the storm.

In some things certainly the gray rabbit is quite particular, and sometimes too much so for its own good. So inquisitorious is it of small things on the way, that when in full retreat before the dog, the whistle of the hunter to stop the hound, will sometimes stop the rabbit also. Even the clicking when setting the hammer of the gun will check the poor dazed thing in its flight, for it must know what the unusual sound is. True the pause is only for an instant, but that is enough for the sportsman's aim. In the woods the rabbit will course through the underbrush, then, after making a tremendous leap at right angles, will double his track. These movements it will vary with zig-zags, greatly bothering the hounds; not seeming to look for a hole unless it be closely pressed, and a hollow tree offers an illusive asylum. In cleared land it makes for a known hiding place. And generally it knows all the good spots in a wide territory. My friend, Mr. Geo. H. Vanderbeck, an intelligent farmer, gives me the follow-

ing: Once after a heavy fall of snow he marked a rabbit trail at considerable distance from the house. It led in a straight line to the hennery, in which the game was found, having sought this shelter from the cold. From the directness of the trail it was evident that the animal had full knowledge of this retreat. He told me too of an old buck which he had often tried to take, but which would either by a direct or circuitous route, retreat to a deserted marmot's or woodchuck's hole, which it had long occupied.

Two distinct kinds of tracks have been mentioned, that which is made in retreat and that which is made when foraging. To these a third must be added having two sets of imprints, in lines close and parallel to each other, and the step-marks at very short distances. These are the courting tracks. At the turn of midwinter, or about the beginning of February the male looks up his mate or mates. While the love emotion is on, prudence is off; hence, less cautious than usual, they do fall into some indiscretions which imperil their safety. In truth it is with these simple folks much as it is with some thought to be wiser—when much love is in, some wit is out. If the snow or the ground be soft, these double-tracks, or courting ways, betray what is going on, and sometimes the nearness of the lovers. Our rabbit likes a bit of play in the evening twilight and the early morning dawn, hence it has been called a crepuscular animal. But it is essentially a nocturnal, like the rodents generally; and the evening and the morning are its wooing day. The connubial impact made, the doe has much to pull through, for the gay father is away with other loves. If the season prove favorable, three and perhaps four litters are to be raised ere the next winter comes. As an old rabbiter said: "Three crops in one season is only moderate for a she rabbit."

As to the breeding habits of the wood-hare, it must surely have undergone a change in the well populated places east. A thorough hunter tells me, he has never found a nest in the woods nor even a very young rabbit there; that for breeding they prefer the cleared land. This habit secures an open look-out and guards against surprise.

But the breeding nest of the gray rabbit is a simple affair. A hole is scratched sloping downward into the ground about eighteen inches. The slope is slight, so that the nest is very near the sur-

face. It has a bed made of dry leaves and grass, and on top some fur or hair, which the mother has torn from her own breast. The litter numbers from four to six. So small is the hole that the mother cannot nestle in it with her young, but she suckles them at the front or entrance, where she adjusts herself, then by a sort of *wuzzling*, not *purring*, sound, she calls the little ones, the call being at once obeyed. The maternal brooding and fondling which impart so much comfort to the mother's care, are unknown to our gray rabbit. During the suckling period she occupies a slight depression in the ground a few yards off, from which the motherly watch is kept. I think she can give the alarm to her little ones, for they will keep well back in their nest and very quiet in time of danger, while the mother from her form will endeavor to divert an enemy. But despite these vigils something may happen to bring the tenderlings to grief. Should they escape preying animals, for the mother is courageous in defence yet the sloping nature of the nest invites the rain, and a storm may drown the whole litter. Then the shallowness of the nest is such that the plough has often turned up all to perish in the cold winds of March. Should all go well, three weeks of suckling will suffice, when they become so large as to crowd their cave-like nest. Now the mother sets them adrift. The rabbit litters when very young, ere it has attained half its growth. A female may have two litters raised before she is a year old.

As already hinted, the male of *L. sylvaticus* gives himself no concern about the little ones, and is of loose morals at best. As for the petted *L. cuniculus*, he is no better than a beastly blue-beard in his own household. But lest all father hares be set down as so depraved, I shall instance, by way of episode, a pretty exception, even should the story seem to some sensational. In the months of May and June, 1860, Professor F. V. Hayden and his party of U. S. explorers, found themselves up in the Alpine snows of the Wind River mountains, where they were detained several days in an attempt to feel their way to the Yellowstone. On the 31st of May Dr. Hayden declared that a new species of hare was around, as he had observed unusually large hare tracks in the snow. As the Doctor expressed himself to us: "The tracks were very large, the feet being wide-spread, and the hair thick between the toes, thus really furnishing the animal with snow-shoes." In June one was captured, and the Doctor named

the species, *Lepus bairdii.* The animal seemed limited to that small Alpine territory. But one specimen was secured, and no more was heard of this hare until 1872, when Dr. Hayden and party were in that region in the months of August and September. At this time five specimens were obtained by Mr. C. Hart Merriam, the naturalist to the Hayden Survey; of these, four were adult males, and all had large teats and udders full of milk. The hair around the nipples was wet and stuck to them, showing that they had just been suckling their young. To make all certain, resort was had to dissection, when the sex was demonstrated. Not only did Mr. Merriam make dissection, but also Dr. Josiah Curtis, a naturalist of the U. S. Geol. Survey, with the same result. In the face of such testimony disbelief would seem discourtesy. This hare is doubtless an Alpine form, says Allen, "inhabiting the snowy summits of the high portions of the Rocky mountains." It has been found as far south as New Mexico. In winter its entire dress is white; but in summer the pelage generally is dark plumbeous, like that of the house mouse, "the feet are wholly white." If not in exquisite taste, it certainly is peculiar—for white satin shoes can hardly look well on large splay feet. It is a pity that as yet nothing has been learned of the female. We want to know more of their family matters. How much of this nursing is done by the mother; or does she relegate all to the obliging father; or are there two broods to be suckled, the first being unweaned when the second one arrives? In the rigor of their mountain home do the leverets need longer nourishing than their little cousins in the plains? The larger rodent, the beaver, allows two litters in the lodge, but the first litter is supposed to be weaned. If a long suckling of the little hares is necessary, so that one litter is not weaned before the other comes, it would be interesting to know if two nests are occupied, the older litter being left for the father to finish their bringing up. The wood-hare east is polygamous. It is hardly supposable that Baird's hare is so too, as that would make his duties as wet-nurse somewhat exacting. If then he is the one husband of the one wife, in every way his virtues outshine all that can be said for his loose kinsman in the east. But we need more light.

The striking out of the hind limbs of an adult rabbit with the claws distended, has often proved more than a match for a cat.

And little wonder that the hind limbs, with their armament of claws should be quite effective when we recall that grand out-fit of muscles, which enables them to make such prodigious leaps. We spoke of the surprise of the immigrant at the lusty kicking of the entrapped rabbit. Such conduct is, however, exceptional, or at most it lasts for a very short time. When taken by the hand, the captured rabbit at first, in its terror, utters a plaintive but musical cry; it is not properly a squeak; and after a few impotent struggles, it is dazed into a passive submission. Thus an adult gray rabbit may be carried lying full length on one's arm, the front toes being loosely held between the fingers, although it has been taken but five minutes from the trap. After a little show of resistance it has submitted to the situation. Once when riding with my daughter, we came upon a gorgeous patch of *Lupinus perennis* by the roadside. I got out to gather some, when a young rabbit sprang out of the glowing bed of purple bloom. It dashed into a heap of brush near by, which enabled me to capture it without inflicting injury. I bore my pretty prize to the carriage. But though only for a moment, that plaintive whistle in the minor key, so flute-like and so pitiful, kept piping in our ears. Our hearts misgave us. Daughter plead for the little prisoner's release; that decided the matter. I bore it gently back to the bed of lupines, where it easily hid itself, and like a helpless little prince was safe under the royal purple.

This almost non-resistant quality of the gray rabbit, has given me a liking for it. It is your pampered tame one that excels in the mulish accomplishment of kicking at his master. But when "striking out" becomes a virtue, the mother gray-back has been known to shine. Once when inspecting the animals of a certain institution, unconsciously I was getting too near a long-eared mongrel, at which his tender shouted: "Keep away from that mule or he'll stoop up at you, and if you do excite his upsetting sin you'll get his compliments, and you won't forget it either!" We ejaculated: "The long-eared hybrid!" "Yes, sir, that's so," responded the animal-man, "he is high bred. His father before him was a good trick mule." What sharp observers these "animal-men" are. Who but the mule-man could so tersely describe the precise pivotal politeness of the beast. And what method in his salaam to a stranger. First the ears are set well back. Next, down goes the head, then, as if this formalist were fulcrumed at

the middle, upward and backward go the heels; and the impression made is not to be forgotten. But for real "fancy sparring," no trick-mule could equal the deftly hitting of that mother gray-back who fought a huge black snake to rescue her young one. The reptile was rapidly bearing it away. A little low cry, though at quite a distance, was heard by the mother-hare, for their sense of hearing is marvelously keen. A few desperate leaps and she had caught up and joined issue with her dreadful foe. The snake dropped its prey, its sulphurous eyes glowed in luminous rage, and it sprang. But the heroic mother leaped into the air, making a curve over its enemy, and just at passing the middle of this arc putting in most deftly a double shot behind, which sent the serpent rolling and squirming in the dust. This feat was several times repeated, the snake darting and snapping wildly, until its mouth was filled with hair, without inflicting any real hurt on the little heroine. The reptile was cowering fast and would fain slink away; but the witness of this fierce battle now came to the rabbit's aid. The black reptile was soon destroyed, and the brave mother left to her little one.

I think the above should warrant a clear distinction between timidity and cowardice. It is the bravery of maternal desperation. Though succumbing at last, I have witnessed a gallant fight of a young rat with a large pine snake (*Pituophis melanoleucus*). These very serpents are fond of young rabbits, and will capture them much as they do birds. Call it enchantment, fascination, charming, or what one will, there is a fearful nervous subjection. The poor little beast loses head. A farmer in the Pines told me that he saw at some distance up the road, a half-grown rabbit, and was somewhat surprised to see that it did not stir at his coming, but looked steadily at one spot. There was a large pine snake slowly crawling up to its victim. Said he: "I went up to the rabbit, gave it a push with my foot, when it went off at a lively gait. You see the spell was broken. The snake seeing me, made for the woods and got away.

The mink and the weasel are especially feared by the wild rabbit. In Europe the ferret is used to hunt rabbits. If our common weasel appears in a neighborhood, the rabbits will soon be exterminated for a considerable area.

In the winter the gray-rabbit is very destructive to young trees, and is the dread of the nurseryman, although much mischief laid

to them is chargeable to the field mice, which will bark trees both below and above the snow line. The rabbit will girdle young trees, and the very small trees of the nursery it will not only bark, but will cut off the branches and eat them. I have in mind a nurseryman who had not yet learned this fact, and would not permit a gray rabbit to be in any way molested on his premises. The tender hearted fellow soon woke up to his mistake. The animals became emboldened and took possession, and very soon many thousands of young trees were utterly ruined. At last, in dismay, he besought the help of his neighbors, and a war of extermination was proclaimed.

Could it be got at, the ancient lore as touching the ancestry of *L. sylvaticus*, would be well worth the telling. Even before history began, though a numerous, the coneys were always a feeble folk, and fair game for all animals carnivorously inclined. In classic Greek we find a word meaning "killing of hares," and the word hare a synonym for coward. And as for the poor fellow who was harried or hen-pecked, their philosopher Posidonius would say: "he led a hare's life." If remoteness of origin may count for much, the ancestry of the hares is extremely ancient. I am puzzled by a small fossil bone now lying on my table. It is from the Dakota Miocene, and is part of the left side of the under jaw of a hare. There are a number of these fossil or extinct American hares, for which Professor Leidy raised the genus Palæolagus, "the ancient hare." This jaw is, I think, that of a young individual, but I dare not guess the immense remoteness of that period in which it had to fulfill its mission as a prolific food provider for the numerous and terrible Felidæ then existing. Probably the environment or life conditions of the Leporidæ have improved since the Miocene times; for my fragment has the five molars so strongly set, and yet so small, that the owner surely was a smaller animal than our gray-rabbit, itself so small among those to which it is germane, as to merit the epithet familiar to naturalists—"the little wood hare." I think the ancient could not achieve the deft leaps of the modern. As I see it, the body was shorter and thicker set, and its pug face, could a fancier but imagine the style, would educe the fancy name, "chunky chaps."

As already seen, the wild rabbit is very prolific; hence it is the only one of our large rodents that in any measure holds its own against the onflow of civilization. And yet its enemies are many.

Even the domestic cat will take to the woods and become almost a fera, and subsist largely on young rabbits. To man with dog and gun, the pursuit of the rabbit seems to have a fascination. To me, the yelping bark of the hound when he has scented the little thing, is always distressing. Old rabbit hunters claim that the three different kinds of sounds, when the dogs are baying, denote different grades of strain in the hounds. There is the short snappish yelp of the hound of low degree; the whining, yet almost percussive howl which marks the dog of fair and even good points; then there is that long-drawn, deep-mouthed baying which leaves that ancestral war-whoop far behind—

"The wolf's long howl on Ounalaska's shore."

This can be heard far away, and denotes the hound of highest strain. I dislike them all, but this specially exaggerated wolfish baying is to me indescribably dismal. But judgments differ. Doubtless the devotee hears music in the frenzy of the howling dervish. I knew the father of a necessitous family. He kept one of these fiendishly accomplished brutes. The man must have had not an ear but two, for music, the one sa a pietist in church, the other as an enthusiast afield; for he said to a fellow sport: "In meetin' I have my favorite hymn, but the sound of that hound when he has nosed a rabbit, is to me real heavenly music!" As the poor miner declared, when half dazed over the death of his chum, this whole business is "too technical for me!"

I am so much pleased with the sight of little gray-back in the orchard near my study. With no dog near, he is in an interesting repose, and the scene is innocent and pretty. In the confidence of safety, it squats, snips off at its base a dandelion leaf, then sits up, and enjoys the crispy dainty. What a picture—ears erect and wide open; and that nibbling or clipping diminution of the leaf, those soft staring eyes, and that funny winking mug. Now for that habit of circumspection. Poised on its hind feet, with neck a little stretched, how those lustrous eyes survey the situation, while the ears are set erect and expanded to catch the slightest sound. Ah! it has heard something, and off it goes at almost flying speed, bearing that cottony caudal tuft aloft behind it. If for mere display that white cockade may suggest a spice of vanity in rabbit life; but if from other motives it may hint at some serious verities in its experience. If it be the "white feather," who will blame timidity where every hand is

hostile? if a flag of truce, it has never been regarded. How much this little mammal has to do in sustaining the faunal balance in the east! To how many forms of life is it a food supply —to the creeping reptiles, the raptores of the birds, the rapacia of beasts, and even all-rapacious man. "Behold, therefore, the goodness and severity of God." Such is the rectitude of existence that whether beast or man, "no one liveth to himself, and no man dieth to himself."

> "The whole temporal show related royally,
> And built up to eterne significance,
> Through the open arms of God."

But why tempt the depths? So here endeth this memoir of "little cotton tail."

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THE PALÆOZOIC ALLIES OF NEBALIA.

BY A. S. PACKARD, JR.

HAVING studied the anatomy and development of Nebalia, we are prepared to compare it with a group of fossil forms which are scattered through the older Palæozoic rocks from the lowest Silurian to the Carboniferous. In a brief article[1] Mr. Salter, nearly twenty years since, sketched out the characters and showed the relationship of Ceratiocaris and a number of allied forms to Nebalia in the following paragraph:

"Before the structure of Ceratiocaris was known, of which genus a reduced figure is here given, the rostral portion of Peltocaris could not have been understood. But a reference to the accompanying series of wood-cuts[2] will show that a tolerably broad rostrum, placed in the same relative position, occurs in Ceratiocaris. In the recent Nebalia it is fixed, and in Dithyrocaris and other genera it is perhaps yet to be discovered. Again, Ceratiocaris, together with its movable rostrum, has a bivalved shell, yet habitually keeps its valves half closed, as I learn from perfect specimens."

Salter then enumerates the characteristics of the fossil genera, beginning with Hymenocaris, which he considers the more generalized type, and in the wood-cuts, which we partly here produce, shows the geological succession of these genera, which also serves as a genealogical table. He regards them as Phyllopods, associating with them Estheria and Apus, regarding the latter as

[1] On Peltocaris, a new genus of Silurian Crustacea, by J. W. Salter, Quarterly Journal of the Geological Society of London, Vol. XIX, 1863, p. 87.

[2] Our Fig. 1.

"the most complete and decided form, and it is one of the latest of the group, as it commences in the Trias." He also says: "The links between these coal-measure forms and those of recent times,

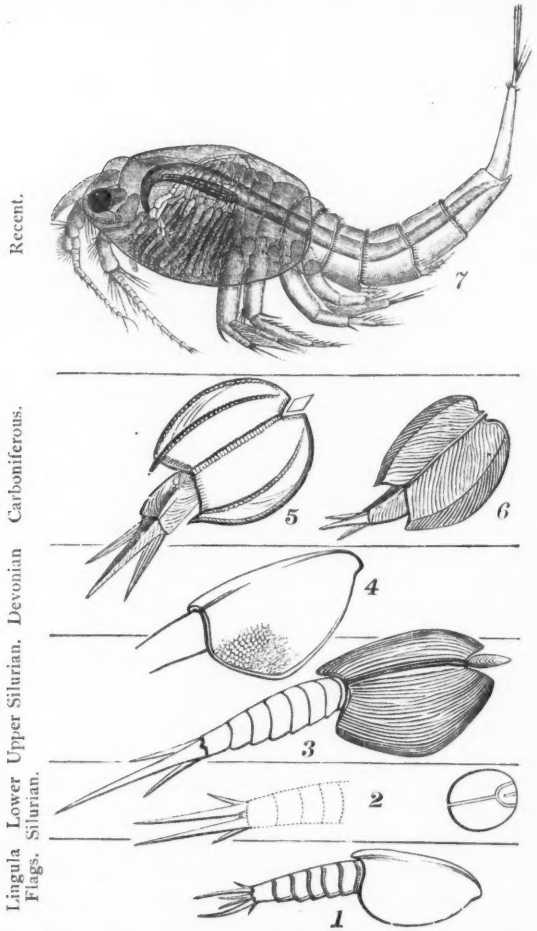

FIG. 1.—Hymenocaris (Lingula Flags). FIG. 2.— Peltocaris (Lower Silurian). FIG. 3.—Ceratiocaris (Upper Silurian). FIG. 4.—Dictyocaris (Devonian). FIG. 5.—Dithyrocaris (Carboniferous). (FIG. 6.—Argus.) FIG. 7.—Nebalia (recent).

are many of them wanting; but in Nebalia we have a good representative of the compact, shield-shaped form of Ceratiocaris the two valves soldered into one, and the rostrum attached, the

eyes being still beneath the carapace." It is evident from this that Mr. Salter regarded the fossil genera he enumerates as allied to and as the ancestors of Nebalia, and as representatives of it in Palæozoic times. He evidently adopted the views of Milne-Edwards and others as to the Phyllopodous nature of Nebalia.

Discarding the Phyllopod forms, we here reproduce Salter's figures and geological succession, which has been confirmed by the discoveries of Barrande and H. Woodward. Salter's figure of Nebalia is, however, replaced by an original one of *Nebalia bipes*.

In his article on the structure and systematic position of Nebalia,[1] Claus thus refers to the Palæozoic forms:

"It is generally considered that the oldest Palæozoic Crustacean remains whose shells and form of the body partly resemble Apus and partly show a great similarity to Nebalia, for this reason are considered to be Phyllopods, though we are without any information as to the nature of the limbs. But now the instructive error, to which the consideration of Nebalia gave occasion, will lead us to exercise greater caution in the interpretation of such incomplete and imperfectly known remains.

"In Ceratiocaris Salter, we have a great Nebalia-like carapace by which a series of free segments were covered, and moreover a long well-separated, lancet-formed rostrum. On the other hand, the form of the abdomen, with the powerfully developed telson beset with lateral spines, indicates a different form, which also finds expression in the appendages of *C. papilio* Salt., figured as antennæ or thoracic limbs. If these representations indicate true limbs, then they remind us most of the larval limbs of Decapods. So also the position of Dictyocaris Salt., and Dithyrocaris of Scouler to the other Silurian fossils regarded as Phyllopods (Hymenocaris, Peltocaris) will remain problematical until we have obtained more precise explanations as to the nature of their limbs.

"It is in the highest degree probable, however, that all these forms are not true Phyllopods, but have belonged to a type of Crustacea of which now there are no living representatives, but which, taking their origin from forms allied to the lower types of Entomostraca, have prepared the way for the Malacostracan type. Such a connecting link, which has served to the present day, we evidently find in the genus Nebalia."

In 1879,[2] without knowing the views of Claus, just quoted, we

[1] Siebold u. Kölliker's Zeitschrift, XXII, 1872, p. 329.

[2] The Nebeliad Crustacea as types of a new order. By A. S. Packard, Jr. AMERICAN NATURALIST, February, 1879, Vol. XIII, p. 128.

published a brief notice of the leading characteristics of the group, and proposed that the Palæozoic fossil forms, Ceratiocaris, etc., be united with the Nebaliadæ to form a separate order of Crustacea under the name of Phyllocarida.

FIG. 8.—*Discinocaris browniana*, natural size; side view and disk with the wedge-shaped rostrum in situ. After Woodward.

Of the fossil forms, Hymenocaris was regarded by Salter as "the more generalized type." The genera Peltocaris and Discinocaris characterize the Lower Silurian period, Ceratiocaris the Upper, Dictyocaris the Upper Silurian and the lowest Devonian strata, Dictyocaris and Argus the Carboniferous period.

On examining the figures of Salter and of Barrande, for we have been unable to study any of the fossils themselves, owing to their extreme rarity, the relationship to Nebalia is very marked, as seen in the form of the carapace, the nearly free or detached rostrum, unless the separation took place after the death of the animal, and also of the rather long, slender abdomen. Upon examining the appendages at the end of the abdomen there is to be seen an important distinction from Nebalia; a long, slender telson is usually present, with a single pair of large caudal stylets, or cercopoda, in form like those of Nebalia. But in Hymenocaris and Peltocaris the telson appears to be represented by a pair of small (in Peltocaris minute) spines. In the presence of the telson in the typical fossil genus Ceratiocaris, we certainly have an important character separating the type with its allies from Nebalia, and allying them to the Decapods; and thus in the provisional synopsis of the order presented in the memoir soon to be published in Hayden's Report, we have placed the fossil forms in a separate sub-order from the Nebaliadæ.

While the posterior edges of the abdominal segments in Hymenocaris appear to be spined as in Nebalia, there are some characteristics of importance in the fossil forms which deserve mention; these are the sculptured carapace, especially of Dictyocaris, in which the surface is reticulated.[1] Moreover the size of these

[1] It should here be remarked, that while the carapace of Nebalia is smooth, upon making a section of it a reticulated structure is plainly seen in the parenchyma or soft parts of the shell, but it is entirely too minute to be perceptible in the shell even

genera was enormous, but if we, as we seem to be warranted in doing, regard Nebalia as a survivor and decrepid or old-age type of the order, which has lost the ornamentation of the integument, the size and the telson even being dwarfed, smooth-skinned, and in general very simple compared with the forms which existed at the time when the type culminated and before it began to die out, we may have an explanation of the greater simplicity of the carapace and abdomen of Nebalia, as compared with its Palæozoic ancestors.

From our total lack of any knowledge of the nature of the limbs of the fossil Phyllocarida, we have to be guided solely by analogy, often an uncertain and delusive guide. But in the absence of any evidence to the contrary,[2] there is every reason to suppose that the appendages of the head, thorax and abdomen were on the type of Nebalia, since there is such a close correspondence in the form of the carapace, rostrum and abdomen.

But whatever may be the differences between the fossil forms represented by Ceratiocaris, etc., they certainly seem to approach Nebalia much nearer than any other known type of Crustacea; they do not belong to the Decapods; they present a vague and general resemblance to the zoëa or larva of the Decapods, but no zoëa has a telson, though one is developed in a postzoëal stage; they do not belong to any other Malacostracous type, nor do they belong to any existing Entomostracous type, using those terms in the old sense. No naturalist or palæontologist has referred them with certainty to the Decapods, or to any other Crustacean type than the Phyllopods. To this type (in the opinion of Metschnikoff and Claus, who have studied them most closely)

under high powers. This structure may be comparable with that of Dictyocaris, especially as Salter remarks (*Ann. and Mag. Nat. Hist.*, 1866, p. 161): "The entire surface of the carapace is marked with hexagonal reticulations one-thirtieth of a line in diameter, of which the areæ are convex and the bounding lines sunk on the exterior aspect. This would, I think, indicate the ornament to be connected with the structure of the carapace rather than to be a mere external sculpturing. As no films can be obtained thick enough to furnish a section for microscopic examination, the point cannot be ascertained."

[2] Close scrutiny of specimens in existence may yet show indications as to the nature of the limbs; for example, Salter figures, in the *Annals and Magazine of Natural History*, 3d series, Vol. v, 1860, p. 154, Fig. 3*e*, what he calls the jaws of *Ceratiocaris papilio*, but the figure appears to us rather to represent a four jointed piece of an antenna. In Fig. 2 there are represented the tergal portion of seven segments lying under the carapace. If fresh attention were directed to the discovery of the nature of the limbs, success might result.

they certainly do not belong; and thus, reasoning by exclusion, they either belong to the group of which Nebalia is a type, or they are members of a lost, extinct group. The natural conclusion, in the light of our present knowledge, is, that they are members of the group represented by the existing Nebalia.

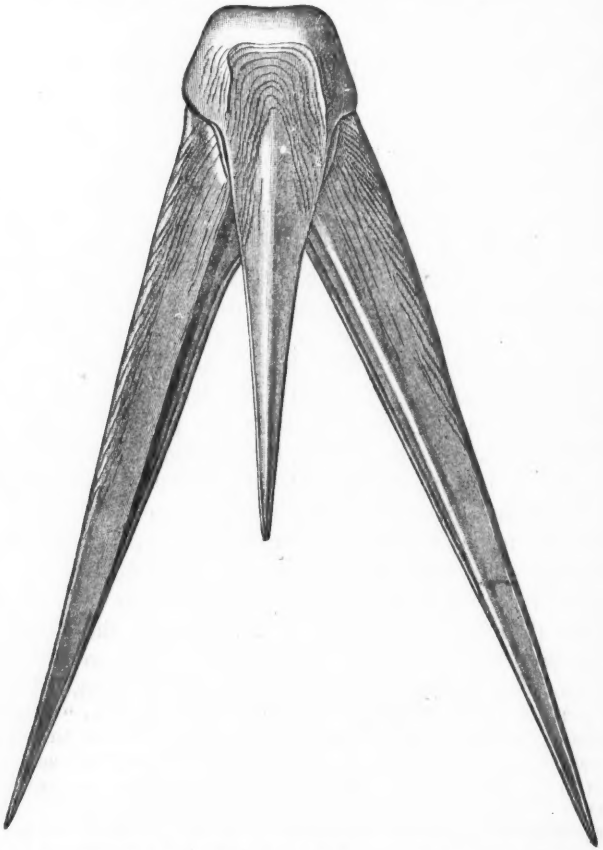

FIG. 9.—*Dithyrocaris neptuni* Hall; telson and cercopoda, natural size. From Hall.

In order, then, to summarize our present knowledge of the living Nebalia and its fossil allies, we will give what we regard as the characters of the group, which may be regarded as provisional, though perhaps of some present use.

External diagnostic characters of the order Phyllocarida.—Body

compressed; consisting of twenty-one segments—five cephalic, eight thoracic and eight abdominal. Carapace compressed, with, no regular hinge, loosely attached to the body by an adductor muscle; with a movable rostrum inserted in a depression in the front edge, the carapace covering the basal joints of the abdomen. One pair of stalked eyes; no simple eyes. Two pairs of well-developed, many-jointed, long, large antennæ, the first pair biramous, the second pair with a very long flagellum in the male. Mandibles weak, with a remarkably long three-jointed palpus. Two pairs of maxillæ; the first with a remarkably long, slender, multiarticulate exopodite; second pair well developed, biramous; no maxillipedes; eight pairs of biramous, broad, thin, respiratory, thoracic feet, not adapted for walking; the exopodites divided into a gill and flabellum; four pairs of large and two pairs of small abdominal swimming feet; no appendages on the seventh segment, the terminal one bearing two long caudal appendages (cercopoda). No telson present in the living species; well developed in the Ceratiocaridæ. Young developed in a brood sac; development direct; no marked metamorphosis; the young but slightly differing from the adult.

Remarks.—By the sum of the foregoing characters the Phyllocarida appear to be excluded from any other group of Neocaridan Crustacea.

The differential characters separating them from the Decapods or any other Malacostracous type, are:

1. The loosely-attached carapace, the two halves connected by an adductor muscle.

2. The movable rostrum, loosely attached to the carapace.

3. The very long and large mandibular palpus; the long, slender appendage of the first maxillæ, and the very long biramous maxillæ.

4. The absence of any maxillipedes.

5. The eight pairs of pseudophyllopod thoracic feet, not adapted for walking; the animal swimming on its back.

7. No zoëa-formed larva.

The differential characters from the Phyllopods are the following:

1. Carapace not hinged; a rostrum present.

2. Two pairs of well-developed long and large multiarticulate antennæ; the hinder pair in the male longer than the first pair.

3. The thorax and its appendages clearly differentiated from an abdomen.

Internal Organs.—No functional shell gland; no highly-developed liver tubes like those of all Phyllopods; stomach and cœcal appendages (liver) entirely unlike those of Phyllopods.

The nervous system is entirely unlike the Phyllopod type, and approaches more the Decapod and Tetradecapod type.

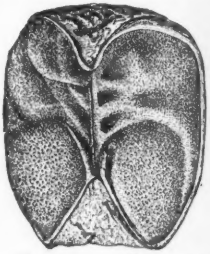

FIG. 10. — *Echinocaris multinodosus.*

FIG. 11. — *Echinocaris sublevis.*

The resemblance to the Copepoda is in some points quite striking; this is seen in the equal size of the two pairs of antennæ, in the form of the abdomen, and the two caudal appendages, as well as the spines on the hind edge of the segment, in the well-developed palpus of the mandibles, in the absence of maxillipedes, as well as the simple reproductive glands.

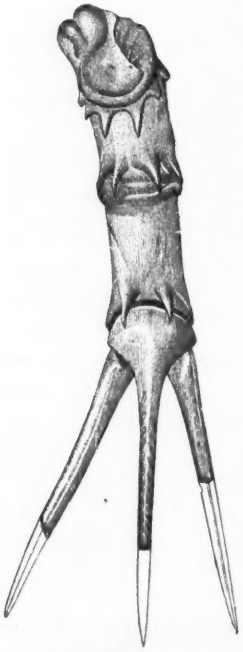

FIG. 12.—*Echinocaris punctatus;* abdomen, dorsal view, natural size. From Hall.

In short, we regard the Phyllocarida as an accelerated, prematurative type of Crustacea which became well established in the lowest Primordial period, flourishing at a time when there was no Malacostracous forms, and which culminated in the Upper Silurian period, and became nearly extinct at the close of the Carboniferous. Judging the group by the structure of Nebalia alone, whether we consider the external or the internal structure, it is a highly composite or synthetic type, combining Copepod, Phyllopod and Decapod-like features with more fundamental characteristic ones of its own. The group existed at a time when, save in the Carboniferous period, no Malacostraca, or at least very few, existed, and they thus anticipated the incoming of the more specialized Decapods.

Like many other synthetic, ancient types, the fossil representatives were of colossal size compared with the living survivors.

While some of the fossil forms were of moderate size, though very large compared with Nebalia, some must have been of gigantic proportions. For example, in *Dithyrocaris neptuni* Hall, of which Fig. 9 represents the telson and cercopoda of natural size, the entire animal must have been some two feet in length. The *Echinocaris punctatus* must have been nearly a foot in length, while the Echinocarides (Figs. 10 and 11), described recently by Mr. R. P. Whitfield, were considerably smaller.

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AMERICAN WORK ON RECENT MOLLUSCA IN 1881.

BY WILLIAM H. DALL.

(Continued from November number.)

Psychology.—Owing to the secluded life of most mollusks they are not easily subjected to long-continued observation, and perhaps for this reason notes on their affections or mental processes are nearly unknown. But that careful observation would reveal in many mollusks a much higher degree of intelligence than they are usually credited with, there can be little doubt. A small contribution to this subject is contained in the paper on "Intelligence in a Snail," by the writer (Am. Nat. Dec. 1881, pp. 976–7). The observations there noted indicate that some species of the genus Helix are capable of recognizing a call or sound, and of distinguishing it from other calls or sounds. Since this was printed the writer has had information of two other cases of the same kind, though the facts are less clearly indicated than in the one first mentioned. Dr. Lockwood's observations on Mytilus indicate a certain degree of intelligence, and it cannot be doubted that observations on cephalopods would show that these highly organized mollusks are capable of more or less complex mental operations.

Geographical Distribution and Catalogues.—In the Annals N. Y. Acad. Sci. (II, pp. 117-126) in an article "On the relations of the fauna and flora of Santa Cruz, W. I.," Bland shows, from a discussion of the land shells, that it is probable that St. Thomas and other islands of the Virgin group were formerly connected with Santa Cruz, but that in spite of a submarine ridge (with, however, 700 fathoms of water over its greatest depression) extending to Saba, there is no evidence of a dry-land connection of the latter

with the rest. He also places some facts on record in regard to an asserted desiccation of the island of Santa Cruz, and concludes that there is no sufficient proof of it nor of an alleged conflagration caused by the French colonists in 1650.

To the "History of Fremont county, Iowa," Professor Call has contributed a chapter on the geology and natural history, which has been separately issued, with new pagination, with the date of Nov., 1880. The Mollusca are treated of on pp. 34–36, where is given a list of thirty fresh-water and ten land shells, none of them peculiar to the locality, more than half of which are bivalves, mostly Naiades.

In the Annals N. Y. Acad. Sci., II, 1881, pp. 129–139, Dr. Stearns discusses the introduction of *Helix aspersa* L., in California, together with the synonymy, relations and habitat of several South Californian species.

"On the geographical distribution of certain fresh-water mollusks of North America, and the probable causes of their variation" (Part I, Jan., 1881, pp. 8; Part II, July, 1881, pp. 11; Journ. Cincinnati Soc. Nat. Hist, IV, 1881). The two papers above cited contain an interesting resumé, from Professor Wetherby's point of view, of a number of singularities in geographical distribution of American fresh-water shells. We are of the opinion that when the facts are fully determined in regard to the fossil as well as the recent forms, which unfortunately is not yet the case, results of value will be obtained. The author wisely does not, as yet, endeavor to formulate any results, but calls attention to the facts with a promise of further studies in the future.

Stearns (AM. NAT., May 1881, pp. 362–6) discusses the distribution and synonymy of "*Mya arenaria* in San Francisco bay," arriving at the doubtless correct conclusion that it has been introduced probably not earlier than 1872 or 1873, on oyster "seed," planted by importers from the eastern coast, to grow and fatten in the bay. It has now almost entirely superseded other "clams" in the San Francisco markets, and has spread or been introduced also at Santa Cruz.

Dr. Lockwood notes (AM. NAT., Nov., 1881, p. 908) the finding of the third fresh specimen (since 1876) of *Argonauta argo* L., on the New Jersey coast. Two occurred at Long Branch, the other fifteen miles south of it. One was living when found. The argonaut may therefore be said with truth to belong to the fauna of the east coast of the United States.

"Observations on the species of the genus Partula Fér., with a bibliographic catalogue," by W. D. Hartman, M.D. (Bull. Mus. Comp. Zoöl., IX, No. 5, 8vo, pp. 171–196, with two diagram plates, Nov., 1881).

This paper contains no descriptions of new species, but is a succinct review of the genus in general, with a list of the species with references to descriptions and figures; a list of terrestrial species as distinguished from those which live in trees; another list of spurious species in which the reference to *P. auriculata* Pfr., as a Tornatella would seem to be a typographical error. There is also an account of an examination of two bushels of duplicates from the Pease collection now in the possession of the Mus. Comp. Zoölogy, and two plates of diagrammatic maps prepared by Andrew Garrett, showing the distribution of the forms of Partula on five of the Polynesian islands. It would seem as if a very important contribution to the study of the origin of species might be made by a keen-eyed and competent observer who should be willing to devote himself for a year or two to the study of these extremely local races, their environment and hybridization, on one of these islands. It is perhaps unnecessary to say that the information in this paper is fuller and more accurate than is to be elsewhere found on the same topic, and that it will be a welcome contribution should Dr. Hartman complete, as it has been rumored was his intention, a similar annotated synonymical catalogue of the Achatinellidæ.

Dr. W. D. Hartman has had printed "A Catalogue of the genus Partula" (F. S. Hickman, West Chester, Pa., 1881, 8vo, pp. 14, cuts), enumerating the species with their synonyms, and dividing them into two sections, of which one contains ten and the other five subordinate groups, and these again are subdivided by characters of less importance. To the divisions of the sections new names have been applied, and they are termed subgenera, though the characters by which they are separated are superficial rather than structural. These subgenera are as follows: Partula (*P. faba* p. 6); Nenia (*P. N. auriculata*, Brod. p. 7); Astræa (*P. A. dentifera*, Pfr. p. 7; preöccupied in cœlenterates, 1789); Clytia (*P. C. umbilicata*, Pse. p. 8; preoccupied in cœlenterates, 1812); Ilia (*P. I. lutea*, Lesson, p. 8; preoccupied in crustacea, 1817); Œnone (*P. Œ. hebe*, Pfr. p. 9; preoccupied in vermes, 1817); Helena (*P. H. Otaheitana*, Brug. p. 9); Pasithea (*P. P. spadicea*, Reeve, p. 10;

preoccupied in cœlenterates, 1812, and otherwise); Ægа (*P. Æ. decussatula* Pfr. p. 11; preoccupied in crustacea, 1815); Echo (*P. E. arguta*, Pease, p. 11; preoccupied in insects, 1853); in the second section Latia (*P. L. ganymedes*, Pfr. p. 12; preoccupied in mollusca, 1849); Evadne (*P. E. bulimoides*, Lesson, p. 12; preoccupied in crustacea, 1846); Harmonia (*P. H. gibba*, Fér. p. 13; preoccupied in insects, 1846); Matuta[1] (*P. M. rosea*, Brod. p. 14; preoccupied in crustacea by Fabricius); Sterope (*P. S. carteriensis*, Quoy and Gaim. p. 14; preoccupied in insects, 1850. The types are illustrated by rather coarse wood-cuts in the text.

This catalogue represents, better than any previous arrangement, the relations of the different species to each other, and is the result of some years conscientious study, aided by the best existing collection of the shells themselves. It is, therefore, unfortunate that, at the last moment, as it were, it should have been somewhat hastily printed. We are authorized, on the part of the author (who as much as any one else regrets the circumstance), to state that he desires to withdraw, as far as lies in his power, the names applied to the sections of Partula, which he is now of the opinion are perhaps hardly important enough, from a systematic point of view, to deserve naming; and that he has in preparation a new catalogue which will embody some revisions, some new species lately described and but recently received by Dr. Hartman, and in which he will adopt the classification indicated by Dr. Pfeiffer in his posthumous work, "Nomenclator Heliciorum Viventium," etc.

A list of the Mollusca (two cephalopods, twenty-five gasteropods, twenty-three lamellibranchs) forms part of a paper by Mr. R. Rathbun, on "The littoral marine fauna of Provincetown, Cape Cod, Mass.," in the Proc. U. S. Nat. Mus., III, pp. 116–133, June, 1880. A reference to this paper was accidentally omitted from this record for 1880.

In Am. Nat., May, 1881, pp. 390–91, Professor R. E. Call describes a new Texan Unio, *U. bollii* Call, from the Colorado river, Texas, collected by the late Professor Jacob Boll. It is perhaps most nearly allied to *U. quadrans* Lea. We may here call attention, though not strictly within our limits, to his list in the July number (p. 585) of the recent land and fresh-water shells found

[1] Printed Matata, but the derivation given shows this to be a typographical error.

fossil in the Iowa loess, and which in his opinion determine it to be a lacustrine formation.

"Notes on *Succinea campestris* and *S. aurea*" (AM. NAT., May, 1881, pp. 391–2). Professor R. E. Call extends the limits of the first species as far as New Orleans in the west, and Charleston, S. C., on the north, and of the second to Central and Southeastern New York. He also adds Southwest Iowa (Nishnabotna river) as a new and so far the most western locality for *Unio pressus* Lea.

Our Home and Science Gossip, a monthly periodical published at Rockford, Illinois, has a "department" devoted to *Conchology* which deserves encouragement and a better proof-reader. In the number for June 15th, 1881, A. A. Hinkley mentions a pond near the Pecatonica river, near Rockford, and Mercer county, Illinois, as localities for the rare *Limnæa zebra* Tryon.

W. W. Calkins announces a "complete monograph" of the molluscan fauna of Illinois, to be published within the year, and asks for coöperation from local naturalists. The object of Mr. Calkins is a worthy one, and which should be promoted at home and imitated in other States of the Union, especially if Mr. Calkins gives as good figures of the species as those which have illustrated some of his papers noticed in this record for previous years.

J. B. Upson contributes notes on *Limnæa desidiosa* Say, and *Physa gyrina* (found by "millions," in a rain-flooded stone quarry which was thirty-five rods from any stream of water), *Unio alatus* Say, and *Vertigo simplex* Gould. Large numbers of the Unio from Rock river, were examined. Two-thirds proved to be males. Young ones were extremely rare. The nacre of the females, without exception, was much lighter than that of the males, being sometimes nearly white, while the males were of various shades of purple. In the male shells the intensity of color varied with the "thickness of the mantle," the shells of darkest hue being secreted by "the very thickest mantle." They sometimes produce pearls. The Vertigo was described by Gould in 1840, and has been found in Canada and New England. In the winter of 1880–81, Mr. Upson found it near Cedar Keys, Florida, associated with *Pupa rupicola* Say, on decayed wood. No intermediate stations are known, and further confirmation of this very interesting discovery would be gratifying.

Mr. Upson also contributes hints to collectors, and offers prizes for the best collections made by children of the public schools.

It will be seen that this little miscellany is by no means without interest, but worse typographical blunders than those which occur in it are rarely to be found, and the editor has included an account of "coon oysters" on the coast of Florida, clipped from some exchange, under the head of *Icthyology!*

Descriptive and Systematic Papers.—As usual, the recorder finds it difficult to assign many papers to any of the definite heads used in this record, since they combine descriptive and other matters under one title, and the recorder's time and facilities do not permit him to attempt any exhaustive analysis like that of Professor von Martens in the *Zoölogical Record.* Still the rough arrangement here adopted is not without a certain use, and for that reason has been retained.

"On the genera of Chitons," by W. H. Dall (Proc. U. S. Nat. Mus., 1881, pp. 279–291, Dec.). In this article the writer has given brief but sufficient diagnosis of all the divisions of the Chitonidæ recognized by the late Dr. Carpenter and himself, both recent and fossil. All the groups are restricted, some here first characterized, but most of them have heretofore been made public. In the present arrangement all are brought together in their systematic relations, and their chief characteristics tabulated. The writer observes, "with the above data and those comprised in my report on the Limpets and Chitons of Alaska, students should be pretty well able to refer any Chiton of whose characters they have made themselves masters, to its proper place in the general classification." The following names are proposed for Palæozoic Chitons on the authority of Dr. Carpenter's MSS., and should be credited to him. Chonechiton, Pterochiton, Loricites and Probolæum. Cymatochiton Dall, is proposed for Cymatodus Carpenter, preoccupied in vertebrates.

Among recent genera and subgenera hitherto only in MS. or imperfectly characterized, diagnoses are given of Deshayesiella Cpr., Callochiton Gray, Stereochiton Cpr., Leptoplax Cpr., Spongiochiton Cpr., Callistoplax Cpr., Angasia Cpr., Ceratozona Dall (for Ceratophorus Cpr., non Diesing, 1850), Pallochiton Dall (Hemphillia Cpr., non Binney), Fannettia Dall (Fannia Gray, non Robineau-Desvoidy, 1830), Sclerochiton Cpr., Lucilina Dall (Lucia Gld., non Swainson, 1833), Francisia Cpr., Dinoplax Cpr.,

Middendorfia Cpr. (Dawsonia Cpr., 1873, preoc.), Beanella Dall (Beania Cpr. non Johnstone), Arthuria Cpr., Aulacochiton (Shuttleworth restr.) Cpr., Fremblya H. Adams (= Streptochiton Cpr., MS.), Euplaciphora (Shuttleworth restr.) Cpr., Guildingia Cpr., Macandrellus Cpr., Stectoplax Cpr., Choneplax Cpr., Chitoniscus Cpr. (non Herrmanssen). It is believed that the publication of these tables will be beneficial in several ways, as in giving a general view of Dr. Carpenter's classification, and especially in calling attention to the characters which it is desirable should be distinctly noted by those who may describe new species of Chitonidæ, for the want of which it is impracticable in the majority of cases, to properly classify by determining the genus or even to subsequently recognize the species. The publication of the entire monograph only awaits the preparation of the illustrations (already drawn) which have been delayed by circumstances entirely beyond the writer's control.

"The Cephalopods of the northeastern coast of America." Part II. "The smaller Cephalopods (etc.)," by A. E. Verrill (Trans. Conn. Acad. Sci., v., pp. 259–446, pl. XXVI–LVI, June, 1880, Dec., 1881). Part I of this important work was noticed in this record for 1880. The second part is now completed, forming full material for a manual of the subject, which it is understood will be issued in the form of a "Report on the Cephalopods," in connection with the "U. S. Fish Commission Report for 1879," which appears early in 1882.[1] The first two sheets, which appeared in 1880, contain references to additional specimens of *Architeuthis harveyi*, and a full description of *Ommastrephes illecebrosus* (Lesueur) Verrill. The new names applied in the subsequent portion of the paper are Cheloteuthis for *C. rapax* n. s. (by typographical error Chiloteuthis) from a somewhat imperfect specimen which is subsequently referred to as a synonym of *Lestoteuthis fabricii* (Stp.) Verrill (*Sepia loligo* Fabr. Fauna Grönl.); Desmoteuthidæ V. fam. nov. containing Desmoteuthis n. g. erected upon *Leachia hyperborea* Stp.; two new varieties (borealis and pallida) of *Loligo pealei* Lesueur; Stoloteuthis n. g. for *Sepiola leucoptera* V.; *Rossia megaptera* V. n. s. from near Newfoundland; and Alloposidæ V. fam. nov. for Alloposus V. (1880). An appendix follows, with descriptions of additional material and a crit-

[1] Separate copies of this article in advance of the Report were received from the printer at the Smithsonian Inst. April 10, 1882.

icism of several papers by Streenstrup and Owen, published nearly simultaneously with the earlier parts of Verrill's work, thereby causing some entanglements in nomenclature, for an account of which the reader is referred to the paper itself. Several new names appear in this appendix, e. g. *Brachioteuthis* (*beanii* V.) g. et sp. n. from fish stomachs off Martha's Vineyard; *Chiroteuthis lacertosa* V. n. s. for a form from the eastern coast of North America of which a fragment was referred to *C. bonplandi* by Verrill in the Bull. Mus. Comp. Zoölogy. VIII, Mar. 1881; Stoloteuthis (cf. antèa); Inioteuthis n. g. with *I. japonica* and *I. Morsei* V. spp. n. from Yedo Bay, Japan, collected by Professor Morse. Then follows a conspectus of the families, genera and species of Cephalopods included in this paper, specimens of all of which, except *Taonius pavo*, have been examined by the author. The plates reflect much credit on the artist, Mr. Emerton, those which are lithographed coming out with particular beauty.

"Some notes on American land shells" (I–II, pp. 8 and 13, Journ. Cincinnati Soc. Nat. History, IV, Oct. and Dec., 1881). In these papers Professor A. G. Wetherby discusses the habitat, location, synonyms, etc., of a large number of species of pulmonates. *Ariolimax* var. *hecoxi* is proposed for a form from California which appears to differ from *A. columbianus*. When fully extended, living specimens reach nine inches in length. An albino variety of *Helix fidelis* is noted from Washington Territory. In the second part the molluscan fauna of Roan mountain, North Carolina, is considered, and *Helicodiscus fimbriatus* n. s. is described (p. 9, separate copies). *Patula sampsoni* is proposed as a name for a form closely allied to *P. dorfeuilliana* Lea from Eureka Springs, Ark. The paper closes with an appeal to and some instructions for collectors.

In the *American Journal of Science* (Volume XXII, pp. 411–14, Nov., 1881), Professor Verrill briefly reviews recent papers relating to the East American invertebrate fauna.

Professor Angelo Heilprin (Proc. Acad. Nat. Sci., Phil., Dec., 1881, pp. 423–28) publishes "Remarks on the molluscan genera Hippagus, Verticordia and Pecchiolia," in which he calls attention to and details the confusion existing in regard to these genera, without, however, finally resolving the difficulties. He is disposed to retain Hippagus as distinct from Crenella (to which it has very generally been referred), on the ground that the shell

(of Lea's types of Hippagus) is thicker and the umbones more prominently developed and spirally twisted than in Crenella, while on the possibly eroded hinge line he observes no crenulations. In general, however, these would hardly be taken to be "sufficient differences to warrant a generic separation."

Bland, in the Annals. N. Y. Acad. Sci. (II., pp. 115–16), describes (with a figure) a somewhat remarkable new species of Triodopsis (*T. levettei* Bld.) from the vicinity of Santa Fé, New Mexico. In the same publication (pp. 127–28 with cut) he has an article entitled "Notes on *Macroceramus kieneri* Pfr., and *M. pontificus* Gld.," in which he figures the former (from types) and comes to the conclusion that the two are distinct, and that *M. kieneri* Pfr., is not a member of the fauna of the United States.

Geo. W. Harper describes and figures (Cin. Journ. Nat. Hist., IV., part 3, p. 258, Oct., '81) *Patuli bryanti* n. s., from North Carolina, which bears a relation to *P. perspectiva* such as *Helix cumberlandiana* does to *H. alternata.* He also figures, with notes upon the species, *Hyalina significans* Bland.

Rafael Arango describes (Proc. Acad. Nat. Sci., Philadelphia, 1881, pp. 15–16) *Choanopoma acervatum, Cylindrella paradoxa, C. incerta,* these three illustrated by good cuts, and *Ctenopoma nodiferum,* all new species, together with *Ctenopoma wrightianum* Gundlach, n. sp. These new pulmonates are from Cuba.

Economic Shell-fisheries and Miscellaneous Notes.—The daily press in this, as in almost every field, gathers good wheat as well as chaff, and, occasionally, articles which would do no discredit to permanent scientific literature. Such of the latter as have fallen under the writer's notice are here mentioned as well as more pretentious documents and reports, as in previous years.

"The Oyster Industry," by Ernest Ingersoll (Tenth Census, Section x, Fishery Industries, Monograph B., Dept. Interior, 4to, p. 252, pl. XXX-XLII, Washington, 1881). This forms one of the special monographs on the history and present condition of the fishery industries, by G. Brown Goode, Assistant Director U. S. Nat. Mus., and a staff of associates. It contains descriptive and statistical reports on the oyster industry from Maine to Texas and California; an account of the natural history of the oyster, a glossary of terms and statistical tables. Six of the plates illustrate the development of the oyster from observations by Professor W. K. Brooks (elsewhere noticed) and the remainder

tools, barges, etc., pertaining to the business. The vast accumulation of facts brought together is an evidence of great industry, and can be properly estimated only by a specialist familiar with this field. Doubtless, there is some inequality in the character of the information, such as would inevitably result from the sources from which it is derived. Its value will be chiefly realized in the future. For the present, the only criticism which occurs to us, is, that we miss in addition to the accumulated facts, a brief digest from which their bearings might be rapidly gathered. It is probable, however, that this is easier to point out than to remedy.

Report of the Commissioners of Shell-fisheries of Connecticut (Hartford, 1881, 8vo, pp. 35–132), presented to the legislature, January session, 1882. This first report of the Shell-fish Commissioners is included in the same covers, with the sixteenth report of the Fish Commissioners of the State, which occupies the preceding thirty-four pages of the volume. The Shell-fish Commission was established by an act of the legislature approved April 14th, 1881, entitled "An act establishing a State Commission for the designation of oyster grounds," which board is given by Section 1, exclusive jurisdiction over the offshore grounds, north of the New York State line, in Long Island sound, suitable for or occupied by oyster beds. They are empowered to survey and map all the grounds above mentioned, to ascertain the ownership of any that may be claimed by right of occupancy and the area of the natural beds, to report a plan for an equitable taxation of the property in said fisheries, and an annual report of the state of their condition. They are also empowered in the name of the State to grant by written instruments perpetual franchises in such unclaimed grounds, as are not and have not for ten years been natural clam, or oyster beds, to citizens of the State applying for them, paying expenses of survey and one dollar per acre for the same for the purpose of planting or cultivating shell-fish thereon. The deeds are to be registered, maps of special sections made, boundary buoys or stakes set, and provision is made for a legal settlement of disputes.

During the seven months, ending with Nov. 30th, 1881, about $8400.00 had been paid into the State treasury from receipts, while $4000.00 had been drawn for expenses incurred.

The report contains, first, an account of lands registered as private property; second, a brief statement of the character of

the business of oyster cultivation as practiced in Connecticut; third, the report of J. P. Bogart, Esq., engineer of the board, in relation to surveys made, accompanied by a map of the triangulation executed, and a general map of the State oyster grounds; and lastly, an appendix containing the forms of deeds used, and a compend of the laws of Connecticut relating to shell-fish and fisheries. It is creditable to the State of Connecticut that the importance of the subject has received legal recognition, and to the commissioners, Messrs. R. G. Pike, W. M. Hudson, and Geo. N. Woodruff, that so much has been accomplished with so little expense. This has doubtless been largely due to the intelligence and efficiency of the engineer of the board as well as to the exertions of the members of the commission themselves. Should Maryland and Virginia take similar action in the waters of the Chesapeake, and execute the laws already on the statute book, the inevitable depopulation of the oyster grounds now rapidly approaching, and which will deprive over forty thousand people of their means of livelihood, might be long postponed if not entirely prevented. The crass ignorance of those most interested, however, and its effect on State politics, are such that little in the way of rational legislation is to be hoped for, until after the business in the Chesapeake has practically destroyed itself.

General information about the oyster and clam trade can be found in the weekly issues of Hopson's *Sea World*, etc., for the year 1881.

An important article on "Chesapeake oysters" and the oyster trade of that region generally, can be found in the *New York Herald* for Oct. 11th, 1881, and another on "Oysters in season," in the issue of Aug. 26th, 1881. The business began in Baltimore in 1834, but was of little consequence until 1836, when a packing-house, dealing at first chiefly in raw oysters was established by C. S. Maltby. On both shores of the Chesapeake collectively, there is capital to the amount of more than seven and a half millions of dollars invested—over seventeen million bushels of oysters were handled—over forty thousand people and nearly ten thousand vessels and boats were employed in the business, while the wages earned are about seven millions of dollars. This article is largely indebted to the Census Report on the oyster industry for its facts, but presents them in a compact and handy shape.

The consumption of oysters in New York, as appears from the second article referred to, between September 1st and January 1st, is about fifty thousand baskets *a day* (*sic*), containing about two hundred oysters each. From January to May the consumption is about twenty-five per cent. less. This appears to be at the rate of ten millions oysters a day, or eight oysters *per capita* for the entire population of the city, an estimate which seems grossly excessive on the face of it, unless it be understood that the New York dealers sell oysters to private parties or small dealers in the surrounding country, which are included in the above figures, as well as the actual local consumption.

A large natural bed of oysters, covering over one hundred acres was discovered in Smithtown bay, on the north shore of Long Island, N. Y., in September, 1881. It is in deep water and very rough bottom. The discovery created an immense excitement among the fishermen, who flocked from every quarter to avail themselves of the unclaimed treasures.

Lippincott's Magazine (May, 1881, pp. 479–492) has a well-illustrated article on oysters and oyster culture, here and abroad, under the title of "Oyster culture," by W. F. G. Shanks.

"Deterioration of American Oyster beds" is the subject of two articles, by Lieut. Francis Winslow, U. S. N., in the *Popular Science Monthly* (Vol. xx, No. 1, pp. 29–42, Nov., 1881; No. 2. pp. 145–155, Dec., 1881), in which the danger to the Chesapeake beds, now imminent, is pointed out, and remedies are discussed and illustrated by instances of experience of European communities. So long as the community most directly interested remains, from ignorance, obstinately incredulous and unwilling to take any precautions whatever, or even enforce the existing laws, nothing can be done, and it is probable they will awake to the danger only when it is too late.

The Sea World, Fishing Gazette and Packer's Journal, a quarto weekly periodical, devoted in large part to the annals and interests of the edible shell-fish trade, has completed its third volume. It is published by W. B. Hopson at New Haven, Conn., and apparently printed and issued in New York. Those interested in the economical shell-fish will find it worth while to refer to its files. In the number for Dec. 7th, 1881, an interesting account is given of oyster culture, near Groton, Conn., in the Poquonock river. White birch bushes, of proper size, are cut

and stuck into the river bottom (soft mud) where there is about twelve feet of water at low tide. The spat adheres to the bushes and grows finely, twenty-five bushels of oysters (seven bushels marketable and the remainder "seed" oysters) having been taken from one bush which was four inches through the butt and had been set eighteen months. The average yield, however, is about five bushels to the bush. As the bottom is muddy, the spat which is caught by the bushes would otherwise be a complete loss. The oysters are said to be of fine flavor and rather peculiar shape. About fifty acres are devoted to this business. Although the bushes are always under water, a strong opposition to this mode of planting has been developed in the neighborhood which threatens to terminate the trade. The ostensible ground is, that it is liable to produce disease in the vicinity, which would seem to be an unwarranted assumption, and the editor ascribes the attack on the planters to "the determined opposition to oyster culture which has always been noticeable in that section of Connecticut." Why any one should oppose the cultivation of oysters does not seem clear.

In New Haven, Conn., in the autumn of 1881, was reported a singular scarcity of oyster shells for use in planting new beds for the "spat" to settle upon. The value of a bushel of the shells had risen to five and even seven cents a bushel. Formerly surplus oyster shells were used in making roads about New Haven and the smoothness, hardness and freedom from dust of the "shell roads" was so well known as to become proverbial. But the scarcity of the shells, unless it proves to be merely temporary, will soon make the "shell road" a thing of the past.

The franchise for fish and oysters in the Gulf of California is held by Don Guillermo Andrade by a concession from the Mexican authorities. A party has recently gone to investigate the islands covered by his concession, with a view of establishing packing establishments, for putting up turtle flesh and oysters in cans for export.

The "Market Review for 1881" (San Francisco, Cal.), states that the quantity of abalones (Haliotis of several species) shipped by sea from California in 1880, was 6372 sacks, valued at $46,179.00; and in 1881, 4522 sacks, valued at $18,529.00. This is exclusive of the quantity shipped by rail which is probably much greater. Owing to the demand for iridescent buttons now in

fashion, the manufacture of these shells is very large. In this country the work is largely done in Philadelphia and New York. A considerable quantity of the shells are shipped to France; of the more solid and perfect shells, solid buttons are made, the refuse is ground up and mixed with cement which is molded into buttons, which display in their substance myriads of brilliant particles. The compound may be more conveniently and artistically treated than the solid shell itself, as well as at less cost.

An account of "Pearl diving (for *Margaritiphora californica* Cpr.) in the Gulf of California" taken from the "Youth's Companion" appears in the San Francisco *Bulletin* for Nov. 9th, 1881. Two or three tons of fresh shells were obtained per day when weather permitted. They were allowed to die before being searched for pearls. The locality was called Bonita bay, being about fifty miles north of Loreto. The water was forty feet deep and only about one shell in one thousand contained a valuable pearl. Sharks and squids rendered diving (in a suit of rubber armor) exciting, if not dangerous.

Eleven thousand bushels of clams (*Venus mercenaria* L.) were sent to market by the fishermen of East Hampton, Long Island, N. Y., in 1881.

In the Bulletin of the United States Fish Commission (I. p. 21, Apr. 13th, 1881) Mr. John A. Ryder prints an extract from a letter to Mr. Tryon, by Henry Hemphill, calling attention to the valuable qualities of *Glycimeris generosa* Gould, as a food mollusk. It is found at Olympia, Washington Territory, and is said to resemble "scrambled eggs" in taste. They are called "Geoducks" by the urchins of Olympia, and "Kwenuks" by the Indians. The Fish Commission is investigating the question of transplanting these valuable mollusks to the east coast of the United States. In the same publication (pp. 200–201) with the title of "On the habits and distribution of the Geoduck," etc., is printed a letter from Hemphill on the same subject, in which he mentions that a large specimen will afford a pound of delicious flesh for food. They burrow very deeply into the sand, however, and do not come much above extreme low tide limits, so that it is not easy or convenient to get at them except at low spring tides. On the other hand, they are said to be finer eating than any other mollusk, not excepting the oyster.

At a recent meeting of the Harbor Commissioners in San

Francisco, the Chief Engineer reported that the San Rafael ferry-slip, now six and one-half years old, was practically ruined by the teredo and would have to be replaced. Nearly all the submerged wood-work was actually destroyed.—*San Francisco Bulletin.*

W. N. Horton, of Olympia, W. T., has invented a plan for circumventing the teredo. He is also the inventor of a process for boring logs for water pipes and pumps. His machinery cuts out a cylinder two inches thick, from between the core and the outside of a log and of any desired caliber. By retaining the core and filling the cylindrical excavation around it with a special cement, it is thought that the ravages of the teredo would be confined to the outer part of a pile, so treated, and the core which is expected to sustain the needed weight would be protected by the cement, which in its turn would be preserved from friction by the outer coating of wood and bark.

In the *Sea World* elsewhere alluded to (Dec. 7th, 1881), a resumé of facts relating to the giant cuttlefishes, is given, under the title of "The Devil Fish of the Atlantic."

In the *Weekly Bulletin*, San Francisco, Aug. 24, 1881, in an article on "San Francisco Fishermen," it is stated, that the Octopus (*O. punctatus* Gabb) is largely used for food by the Italian fishermen of that port, being made into a kind of chowder with vegetables and a sauce of olive oil and lemon juice, after the intestines have been removed, and is considered as especially appropriate food for fast-days. They are also dried for export by the Chinese.

In the Gulf of California the ten-armed cuttles sometimes attack the divers for pearl oysters. One killed, while attacking a diver, had arms twelve feet long, and a body larger than a beef barrel (*Ib.*, Nov. 9th, 1881.)

The *New York Herald*, of Nov. 25th, 1881, gives three columns to an account, by Mr. Morris, of the capture of an immense squid (*Architeuthis harveyi* V.) at Portugal cove, Newfoundland, on the 10th of November, and a resumé of facts relating to these animals. The specimen in question was brought to New York. *Harper's Weekly* for Dec. 10th, '81, has an illustrated article on the same subject apparently by the same author.

A fictitious account of an imaginary capture of a giant squid ("Architeuthis") appears in *Lippincott's Magazine*, Aug., 1881, p. 124, from the pen of Mr. C. F. Holder.

"Mortality among Architeuthidæ." Professor Verrill (*Am. Journ. Sci.*, XXI, p. 251, Mar., 1881) notes a strange mortality of giant squids ("Architeuthis"), which, according to Capt. J. W. Collins, occurred in Oct., 1875. Twenty or thirty specimens were found floating on the water and secured for bait by the fishing fleet. They were mostly somewhat mutilated when found.

A novel mission in England sends beautiful sea-shells, which are generally collected by children, to little sick people in homes or hospitals. Since May, 1879, it has distributed a quarter of a million of shells from the West Indies, South Africa and Spain, as well as from the English coast.—*Foote's Leisure Hour.*

A specimen of *Tridacna gigas* Lam., weighing 528 pounds, was obtained by Professor Ward, of Rochester, New York, at Singapore. It was thirty-six inches long and twenty-seven broad, and was presented to the California State Mining Bureau, by Mr. J. Z. Davis.—*S. F. Bulletin*, Mar. 2d.

Erratum.—By an inexplicable and unfortunate "lapsus" in this record for 1880 (p. 716), the name of W. H. Ballou was substituted for that of Rev. W. M. Beauchamp, who should have been credited with the authorship of the note on the distribution of *Bythinia tentaculata* in the United States (cf. AM. NAT., July, 1880, p. 523, and Mar., 1882, pp. 244–5).

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THE ORGANIC COMPOUNDS IN THEIR RELATIONS TO LIFE.[1]

BY LESTER F. WARD.

IN a paper on the "Formation of the Chemical Elements,"[2] read March 29, 1879, before the Philosophical Society of Washington, I proposed the following *cosmical definitions* of the three principal known forms of matter:

"*1. Chemical Elements.*—Substances whose molecules are composed either of those of other chemical elements of less atomic weight, or of such as are too low to be capable of molar aggregation, and therefore imperceptible to sense: formed during the progress of development of star-systems at temperatures higher

[1] Read before the Philosophical Society of Washington, January 28, 1882; also read before the Biological Section of the American Association for the Advancement of Science at Montreal, August 29, 1882.

[2] "Evolution of the Chemical Elements," in the *Popular Science Monthly*, Vol. XVIII (February, 1881), pp. 526–539.

than can be artificially produced, and hence too stable to be artificially dissociated.

"*2. Inorganic Compounds.*—Substances whose molecules are composed of those of chemical elements or of other inorganic compounds of lower degrees of aggregation: formed in the later stages of the development of planets at high but artificially producible temperatures, and therefore capable of artificial decomposition; and constituting the greater part of the solid crust of cooled-off bodies, their liquid, and a portion of their gaseous envelope.

"*3. Organic Compounds.*—Substances whose highly complex and very unstable molecules are composed of those of chemical elements, inorganic compounds, or organic compounds of lower organization: formed on the cooled surfaces of fully developed planets at life-supporting temperatures."

In that paper I endeavored to show that the so-called chemical elements differ from one another in ways which strongly suggest the possibility that some of them may have been evolved from simpler constituents in much the same manner as the inorganic compounds are formed. These latter were therefore treated as simply forming the continuation of a uniform process of evolution, varied in its character only by the conditions of temperature affecting the globe at the period when these substances were respectively formed upon it. The passage above quoted from the same paper shows also that the development of the organic compounds was looked upon as the still further prolongation of this uniform law operating under the greatly lowered temperatures prevailing on the surface of the earth's crust after its formation. This law was further shown to be none other than that which is known to prevail in each of the higher domains of phenomena, in the mineral, the vegetable, and the animal world—the production of aggregates of higher orders of complexity through the re-compounding of units of lower degrees of simplicity. As indices of this law, and facts of primary significance, it was shown that throughout the scale, so far as traceable, even in the domain of the chemical elements, the molecules constituting each progressively more complex unit, exhibit *increase of mass* accompanied by *decrease of stability.*

The present paper will aim to take the subject up where the former left it, and to confine itself exclusively to an examination

of the last and highest of these products of Nature's alembic—the Organic Compounds.

These substances, as they exist on the globe, are for the most part products of organization, and they were long supposed to possess such subtile properties and composition as to be ever necessarily inscrutable to man. But quantitative chemistry has, within the last half century, not only succeeded in the complete analysis of all such substances obtained from organized beings, but it has also effected the synthesis, or reproduction out of their inorganic elements, of thousands of them. Thus Wöhler, Berthelot, Kolbe, Friedel, Piria, Wertheim, and others have accomplished the manufacture of such bodies as urea, formic, oxalic, lactic, and salicylic acid, numerous alcohols and ethers, glycerine, and a host of essences, including wintergreen, vanilla, mustard, cinnamon, camphor, etc., as well as alizarine and indigo dyes. These facts are sufficient to obliterate completely the line of demarkation formerly supposed to exist between the chemical constitution of inorganic and organic compounds, and when it is remembered that the latter differ as widely from one another as they do from the former in complexity, the uniform process of molecular aggregation cannot be regarded as interrupted at this stage. There is also much indirect evidence, though amounting to proof in but few cases, that the organic compounds, at least some of them, are sometimes directly formed by nature out of their inorganic constituents without the intervention of organized bodies.

These substances have their peculiar properties depending, like those of all other substances, on their molecular constitution ; the artificial glycerine possesses the same sweet taste as the natural product, the manufactured spices yield the same aromas, and the laboratory dyes the same colors as those of the Orient. Many organic compounds are exceedingly complex, their molecules being relatively large, containing several thousand times as much matter as a molecule of hydrogen. Their instability, moreover, bears some proportion to their complexity. Most of them are colloidal in structure and refuse to crystallize; a few of the simpler ones, however, in which the proportion of oxygen is large, as sugar, for example, become crystalline under certain conditions.

The only element which is never absent from any of these compounds is carbon. Oxygen is almost universally present, and the

hydrocarbon group from which it is wanting is quite distinct from all others. Hydrogen comes next in point of regularity, and these three elements make up the great bulk of all organic matter. When nitrogen is added a marked change is made in the nature of the compounds. The nitrogenous group is distinguished especially by its great instability, and also by the number of isomeric forms which these bodies are capable of assuming. The only other elements that enter to any great extent into organic compounds are sulphur and phosphorus. These occur in limited but definite proportions in many of the most complex substances.

The remarkable contrasts which the elements of organic compounds present when compared with one another have been frequently pointed out by different writers, and they are certainly adequate to explain most of the properties possessed by these bodies. The chief characteristic of oxygen is its great chemical activity, or tendency to combine with other substances, while that of nitrogen is its inertia, or inability so to combine. Carbon is a solid at all temperatures producible on the globe, while all the other three chief constituents of organic matter are practically incapable of solidification. This fact is a measure of the degree of cohesion of the homogeneous molecules composing the respective molar aggregates; that of carbon is intense, while that of hydrogen is exceedingly slight. While this in each case depends on the degree of heat, it will be relatively the same among them all at any given temperature.

It would appear that all the attempts, so to speak, on the part of nature to form compounds of the gaseous elements alone have resulted, where successful, in substances which are at once pronounced inorganic, such as water, H_2O, ammonia NH_3, nitric acid, HNO_3, etc. It is remarkable that while the chief compound of the two persistent gases, hydrogen and oxygen, is liquid (water) or solid (ice) at our temperatures, that formed of the persistent solid, carbon, in combination with one of these gases, oxygen (carbonic dioxide, CO_2), is a gas at all ordinary temperatures and pressures. Notwithstanding this, it can not be doubted that carbon is the agent which, by its great molecular cohesion prevents the dissolution of the higher compounds and renders organic substances possible.

As already remarked, the transition from the inorganic to the organic is, from the point of view of chemical structure, purely

nominal, and the existence of any hard and fast line marking off one of these fields from the other has long been denied. If there were any advantage to be derived from such a line perhaps it could not be drawn in a better place than that where carbon unites with hydrogen or nitrogen, either with or without oxygen. This, it is true, would place all the hydrocarbons, as well as cyanogen in the organic series. On this view, therefore, the inorganic compound most nearly related to the organic series would be carbonic acid, or, as it is now more properly called, carbonic dioxide, CO_2, of whose inorganic origin there can be no doubt. The simplest organic compounds consist chiefly in the addition of different proportions of hydrogen to this basis and the reduction of the proportion of oxygen. In the various hydrides (methylic, CH_4, ethylic, C_2H_6, amylic, C_5H_{12}, etc.), the oxygen disappears altogether. In the alcohols it reappears only in the addition of one oxygen molecule, to the respective hydrides. The acids result from an additional increase in the proportion of oxygen (formic, CH_2O_2, acetic, $C_2H_4O_2$, etc.). The actual development of the organic compounds, as it may be supposed to take place in nature, would seem to be in the reverse order to that above given, the organic acids being first formed from inorganic compounds by the addition of hydrogen, then the alcohols from these by still further increase of hydrogen accompanied by a reduction of oxygen, and lastly, the hydrides from the alcohols by the loss of the one equivalent of oxygen remaining in the latter. The different kinds of acids, alcohols, and hydrides, arise from varying the proportions of hydrogen and carbon. The simplest change possible may be indicated thus:

$$\overbrace{CO_2}^{\text{Carbonic dioxide.}} + H_2 = \overbrace{CH_2O_2}^{\text{Formic acid.}};$$

$$CH_2O_2 + H_2 - O = \overbrace{CH_4O}^{\text{Methylic alcohol.}};$$

$$CH_4O - O = \overbrace{CH_4}^{\text{Methyl.}}, \text{ etc.}$$

When we look at the higher and more complex compounds, we can readily see that they may be composed of the lower ones as their molecular constituents. This is, to a great extent, assumed by chemists, and the chemical synthesis of a large num-

ber of these substances has been carefully worked out. In the formation of sugar ($C_{12}H_{22}O_{11}$), starch ($C_{12}H_{20}O_{10}$), gum ($C_{12}H_{20}O_{13}$), etc., the proportion of oxygen is quite large, and the phenomena of crystallization may occur under certain circumstances.

The oils are a still more complex group, being formed by the union of very feeble acids with the common base, glycerine ($C_3H_8O_3$). They are colloidal under all conditions, and decompose much more easily than the amyloids.

The most important organic compounds, however, especially from the biological point of view, are those containing nitrogen. These fall under two general classes, and constitute the so-called organic bases on the one hand, and the albuminoids on the other. The former of these groups have been for the most part extracted from vegetables of which they constitute the "active principles," or characteristic properties, although, as we saw, a large number of them have been artificially manufactured. As illustrations of the nature and composition of these substances may be mentioned, morphine ($C_{17}H_{19}NO_3$), narcotine ($C_{22}H_{23}NO_7$), quinine ($C_{20}H_{24}N_2O_2$), strychnine ($C_{21}H_{22}N_2O_2$), etc. It will be seen that the principal particulars in which these fundamentally differ from the organic compounds already considered, consist in the addition of a small percentage of nitrogen and the reduction of the proportion of oxygen; yet the properties which they possess are a hundred-fold more active.

The composition of the organic bases, however, though somewhat complex, is simple compared with that of the albuminous compounds. These contain, in addition to the elements of the former, small, but rather definite proportions of both sulphur and phosphorus. The number of molecules of each of the components indicates a large, complex molecule as the unit of composition. The expression for albumen as given by Liebig was: $C_{216}H_{338}N_{54}S_3O_{68}$. Could this be relied upon this substance would contain 679 equivalents of different weights, which, when reduced to the standard of hydrogen, would indicate a molecule for albumen 4870 times as large as the hydrogen unit. The molecule of fibrin is supposed to be still larger than that of albumen.

The substances thus composed, as we should naturally expect, are very unstable and possess remarkable properties. They constitute the substance of the muscles and nerves of the animal sys-

tem and the fibrin of blood. They are also found in all cells whether animal or vegetable. The base of the entire group is known as *proteine*, so named from its remarkable power of assuming different isomeric forms, of which it presents some thousand or more. Proteine contains no sulphur nor phosphorus, and its formula as given by its illustrious discoverer, Mulder, is, $C_{18}H_{27}N_4O_6$. Each of its units would thus be composed of 65 elementary molecules, the combined mass of which would be equal to 395 molecules of hydrogen. All the actual known substances of this group have, therefore, more complex molecules than those of this still, to a great extent, theoretical one.

While the albuminoids possess none of the active properties of the organic bases, they far exceed them in the power they have to change their form, and adapt themselves to the needs of organized beings. All properties in material bodies are the result of reactions taking place in their molecular constitution when brought into contact with other bodies. They are recognized only when they directly or indirectly affect the senses. As a rule, the larger their molecules, the more powerful their effects. In the case of the albuminoids, with their comparatively enormous units of aggregation, the entire substance is transformed with only slight external influence, either of heat or chemical contact, and either assumes new characters or breaks up into the simpler organic compounds of which it is composed.

The general law above stated, that in the progress of the evolution of matter from the simplest elemental state to the most complex organic compound, there has constantly been increase in the mass and decrease in the stability of the molecules, holds good throughout, and to it may now be added a third principle, obviously correlated with the above, and merely constituting a corollary to it, that *pari passu* with these changes there has been an *increase in the activity of the properties* manifested by the substances evolved.

Although varying through wide degrees in this respect, all the substances thus far mentioned possess sufficient stability to be retained, handled, and examined, and to the ordinary observer they present very much the same general appearance. While possessing many special qualities distinguishing them from other bodies, the albuminoids, as well as all the other organic compounds, appear to be and are incapable of any visible automatic movement.

We are obliged, however, to suppose that these, like other solids, even the densest crystals or metals, possess at all times molecular activities. It is these activities that determine the respective properties of all substances, and constitute the multiple and varied in nature. In proteine bodies, these molecular activities are much more extensive and varied than are those of simpler bodies. The molecular units are so much larger that their motions must be, as it were, *molar* in comparison, while within these larger primary units there are lesser units of different orders of aggregation, each of which manifests its own appropriate activities, and thus modifies the general properties of the whole. The reason why we are unable to see these motions, is simply because they are still on far too small a scale to be directly observed either by the eye or by any of the appliances yet devised for intensifying human vision.

The development of the albuminoids, highly complex as they are, is not alone sufficient for the immediate genesis of life. A form of matter still more complex, must be reached before this result is possible. But there is no evidence that this form of matter is produced by any different process from that by which other forms of matter are produced. From the molecule of hydrogen to that of albumen, the process of evolution has been uniformly the same, viz., that of compounding and recompounding, of doubly and multiply compounding; in short, it has been the process of molecular aggregation. It would be contrary to the law of uniformity in natural phenomena, upon the recognition of which modern science is based, to assume an abrupt change in the process at this point, and upon those who maintain such a *saltus* must rest the burden of proof.

Dealing, as we constantly must do, with molecules only, we are able to form conclusions only from observed effects, but we have seen that, without changing the elementary substances which analysis can demonstrate to be present at any stage of the process, with each new step in the progress of aggregation new and higher properties are created. From the inert properties of carbon and nitrogen in the free state, of water and carbonic acid, the simplest compounds, we have, by further successive compounding, the more active ones of ammonia and nitric acid, the sweet taste of sugar and glycerine, the powerful narcotic principles of nicotine and morphine, the deadly toxic properties of

strychnine, and, manifesting themselves in a wholly different manner, the still higher order of properties, including those of isomerism, exhibited by the proteine bodies; all of which we seem bound to ascribe to the respective orders of combination and complication, under which these substances, possessing the same elementary constituents, exist when they display these qualities. In short their properties must be regarded as the result of the respective molecular constitution of each substance.

With still higher states of aggregation, could such be conceived as possible, we should therefore naturally expect still higher forms of activity, still more marked properties. But we have learned that, while we may safely predict higher properties from higher degrees of aggregation, we have no basis whatever upon which to predict the nature of these properties. Not even in the simplest inorganic reagencies can we foretell the result of the union of any two elements. We cannot even say which of the three states of matter, the gaseous, the liquid, or the solid, our new compound will exhibit at our temperatures. The invincible solid, carbon, when joined with oxygen, becomes a gas; the type of gases, hydrogen, when combined with another gas, oxygen, results in a solid at 32° Fahr. Much less can we predict the other more special properties, even of these primary compounds. *A fortiori* is human prevision inadequate to presage the result of organic combinations. That the re-compounding of the proteine bodies should result in a new form, possessing the quality of spontaneous movement is *a priori* just as probable as that the addition of a molecule of oxygen should convert the hydrides into alcohols.

This complex stage of aggregation is no longer an hypothetical one. The molar aggregate resulting from such a recompounding of the albuminoids has been discovered. It exists under diverse conditions and manifests properties fully in keeping with its exalted molecular character. This substance, discovered by Oken in 1809, and by him denominated *Urschleim*, recognized by Dujardin in 1835, and called *sarcode*, and thoroughly studied by Mohl in 1846, who named it *protoplasm*, has now passed unchallenged into the nomenclature of modern organic chemistry under the last mentioned designation.

Protoplasm is a chemical substance, found in considerable abundance in nature, not only within the tissues of organized

beings, but as we might almost say, in a mineral state, wholly disconnected from such beings. There is no more doubt that it is a natural product than there is that ammonia is such a product. Its composition has been ascertained with considerable accuracy, and is found to be substantially the same under whatever form it may occur. According to the highest authorities this substance contains, approximately, fifty-four parts of carbon, twenty-one parts of oxygen, sixteen parts of nitrogen, seven parts of hydrogen, and two parts of sulphur in one hundred parts. These proportions doubtless vary somewhat, and traces of other ingredients may, perhaps, be occasionally detected, but the above description is sufficient to fix the chemical character of protoplasm. To write its symbolic formula is impossible in the present state of science, but so is it still impossible, to write that of the albuminoids with any reliable accuracy. Their numerous isomeric forms show us that the grouping of the molecules is subject to constant changes. This is doubtless true to a far greater extent of protoplasm. It is a substance whose molecular units are probably compounded of the units of the proteine bodies, which enter bodily into them in the same manner that oxygen and hydrogen enter into water, or, as we suppose ammonia, carbonic acid, and the compound radicals to enter into the more complex organic compounds.

The many conditions under which protoplasm is found to exist on the globe, may for convenience, be divided into two general classes: the free, and the dependent state. It is a matter of fact that it is found in a free state under a number of forms, both in the sea and in fresh water, and such bodies as Haeckel's Protogenes, and Huxley's Bathybius are simply representatives of it in this condition. On the other hand, protoplasm is present in all organisms, whether animal, vegetable, or protist, and of which, though small in relative quantity, it constitutes by far the most important of all their material constituents. To distinguish the wholly independent, amorphous, and spontaneously developed form of protoplasm above described from that which is found in the tissues of organisms and inseparable from them, Professor Haeckel proposes to apply to it the term *plasson*, or *plasson bodies*, which, while it should not lead to the notion that there is any essential difference in the matter itself, is convenient to aid in retaining the conception, not generally acknowledged, of its purely chemical character.

It is, however, difficult to describe the properties of the plasson bodies without giving rise to the idea of life, since the leading one is that of spontaneous mobility, or motility, as it has been technically called. Anything that moves is naturally supposed to be alive, and if this were a test of life, all forms of protoplasm would be living things. And, indeed, there would be really no objection to this view, provided the idea of life could be rigidly confined to this and a few other simple phenomena. But the tendency is always strong to couple with the notion of life that of *organization*, and few can be brought to recognize either that life can be the product of chemical organization, or that it can precede morphological organization. We are apt to associate with the conception of life, that of nerves, muscles, joints, limbs, stomach, and even sense organs. From the plasson bodies all these are as completely wanting as from a lump of gypsum. The spontaneous movements and all the transformations through which these substances pass, only constitute the mode in which their chemical activities manifest themselves. These activities belong to them in the same sense that sweetness belongs to sugar or astringency to alum. In fact, the primary distinction between these most complex of all known bodies, and the less complex ones seems to be, that while in the latter all their activities are molecular, in the former they are to a certain extent molar, and carry with them the whole or a portion of the substances themselves.

The plasson bodies have recently been made to constitute a special field of scientific research, and as much by accident as otherwise, it has been occupied by the biologists instead of by the chemists. These, like judges on the bench, have constantly ruled in favor of their own jurisdiction, and it is in this way that these substances have come to be regarded as forms of life, although their biographers have from the first insisted that they are not organized beings. Perhaps this bit of history is not unfortunate, since it teaches us to disconnect the ideas of life and organization in the biological sense, and thereby directs our thoughts towards the most profound truth, both of biology and of chemistry, which is that life is the result of the aggregation of matter. A plasson body performs all the essential functions of a living organism. It is capable of motion, nutrition and propagation. To these Professor Haeckel adds sensation, for how can the other functions be conceived of without the aid of this one? But we might almost

as well ask, how can a crystal grow without sensation. Nor has that great naturalist failed to perceive these extreme consequences of this extension of the biological jurisdiction, for he seeks to escape them only by pushing it still farther, and proclaiming the animation of all material atoms, even of the lowest orders—*die Atom-Seele.* It seems far simpler, as well as more correct, to recognize in protoplasm a true chemical substance, but one whose properties constitute the fundamental element of life.

Such a conclusion is no longer the bold speculation that it would have been pronounced a few years ago, and this paper could not be more fittingly concluded than with the words of Professor O. C. Marsh, uttered in 1877, that "if we are permitted to continue in imagination the rapidly converging lines of research pursued to-day, they seem to meet at the point where organic and inorganic nature become one. That this point will yet be reached, I cannot doubt."

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THE REPTILES OF THE AMERICAN EOCENE.

BY E. D. COPE.

REMAINS of *Batrachia* are rare in North American formations later than the Permian. There are two or three species of *Stegocephali* known from the Trias, above which formation that order is not known to extend in any country. No Batrachians have been obtained from the Jurassic or Cretaceous systems excepting from the top of the latter, in the Laramie. Here occur the salamandrine genera *Scapherpeton* and *Hemitrypus* Cope. A single specimen of a frog from the Eocene is mentioned below, and then we miss them until the Loup Fork or Upper Miocene, where *Anura* and salamanders have been found.

The vertebral column and part of the cranium of a probably incompletely developed tailless Batrachian, were procured by Dr. F. V. Hayden, from the fish shales of the Green River epoch, from near Green River City, Wyoming. They are not sufficiently characteristic to enable me to determine the relation of the species to known forms. It is the oldest of the order *Anura* yet discovered, the fossil remains of the known extinct species having been derived from the Miocene and later formations of Europe.

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The Eocene period, was, of the divisions of the Tertiary, the

most prolific of reptilian life. It is true that the orders of reptiles which characterized the Mesozoic periods no longer existed. The *Dinosauria* had perished from the land; the *Ichthyopterygia*, *Sauropterygia* and *Pythonomorpha* no longer inhabited the sea, and the *Pterosauria* had disappeared from the air. What occasioned the remarkable change in reptilian life at the close of the Laramie epoch can only be surmised. During that time the principal land population of North America consisted of *Dinosauria*, of which there were many species and genera. With the opening of the Puerco Eocene, these huge beasts had entirely disappeared, and a population of small and medium sized Mammalia took their place. The comparative feebleness of the new comers precludes the idea that they assaulted and drove out or killed the *Dinosauria*, or that they devoured their food and left them to starve. The only probable hypothesis must suppose that a change of climate ensued, either in a depression of the temperature, or in a desiccation of the atmosphere, which greatly reduced the amount of vegetable life. The large *Dinosauria* would perish from lack of food, where smaller animals could live. That there was a general desiccation at the beginning of the Eocene period in central North America is indicated by topographical evidence. It was towards the close of the Laramie that the elevation of the Rocky mountains was completed, and their greatest effect in retaining the clouds and rains, must have been apparent. Nevertheless, this effect could not have continued, since the later Eocene and Miocene epochs were rich in forests and animal life.

The Eocene reptiles were not a new creation, nor a new evolution, but a remnant of the types that had coëxisted with the monarchs of life during previous ages. We must except from this statement the serpents, which first appear in numbers at this time, only one cretaceous species having been found by Dr. Sauvage, in France. The crocodiles, tortoises, and lacertilians represent orders already abundant in the Mesozoic faunæ. Their decadence in Central North America did not commence until the Miocene period, when the crocodiles and nearly all the tortoises disappeared. From the Loup Fork or Upper Miocene, only a few traces of lizards have been obtained, and snakes were apparently not very numerous. On the eastern coast regions, crocodiles existed, and tortoises were more numerous during the Miocene period; but here also they were less abundant and varied than during the Eocene.

Lacertilia.

Of lizards I have obtained the remains of a half dozen of species, but none of them in a complete state of preservation. Professor Marsh has been more fortunate, as he described from his material from the Bridger beds, twenty-one species.[1] He arranges these under five generic heads, as follows: *Thinosaurus* Marsh, five species; *Glyptosaurus* Marsh, eight species; *Xestops* Cope (1873, *Oreosaurus* Marsh, not Peters), five species; *Tinosaurus* Marsh, two species; and *Iguanavus* Marsh, one species. As Professor Marsh does not give us any clue to the affinities of these forms, they cannot be further considered here. In Lieutenant Wheeler's Survey Report[2] I have pointed out that the dermal scuta and a few other fragments which I obtained in the Wasatch beds of New Mexico, were probably referable to the *Placosauridæ*, a family created by Gervais to receive certain *Lacertilia* of the Eocene of France. To this family no doubt some of the species described by Marsh from the Bridger horizon are to be referred.

The Puerco epoch is characterized by the presence of the suborder *Choristodera*, of which one genus, *Champsosaurus* Cope, holds over from the Laramie Cretaceous. These were large and medium sized animals, somewhat resembling Crocodiles. They have, according to Lemoine, who has discovered them in France, ambulatory limbs, adapted for swimming.

Ophidia.

The snakes of the Eocene are not very numerous as to species.

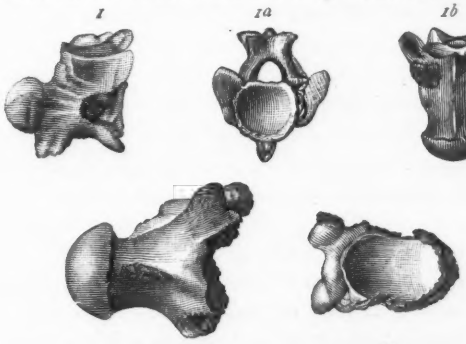


Fig. 1.—*Palæophis littoralis* Cope, from New Jersey. (Original.) Fig. 2.—*Palæophis halidanus* Cope, from New Jersey. (Original.)

[1]American Journal of Science and Arts, 1871, June, and October, 1872.

[2]Vol. IV, pt. II, p. 42, pl. XXXII, fig. 26–36.

The first known American species (*Palæophis littoralis* and *P. halidanus*) were determined by myself from New Jersey specimens. None have been procured from beds lower than the Bridger, and in that formation I found a single form. Professor Marsh described five species.

Species of the genus *Palæophis* occur in the Eocene of England. They are supposed by Owen to be related to the Peropodous or Boæform families. They reached as large a size as the largest existing snakes. Other smaller Eocene species are said to have similar affinities.

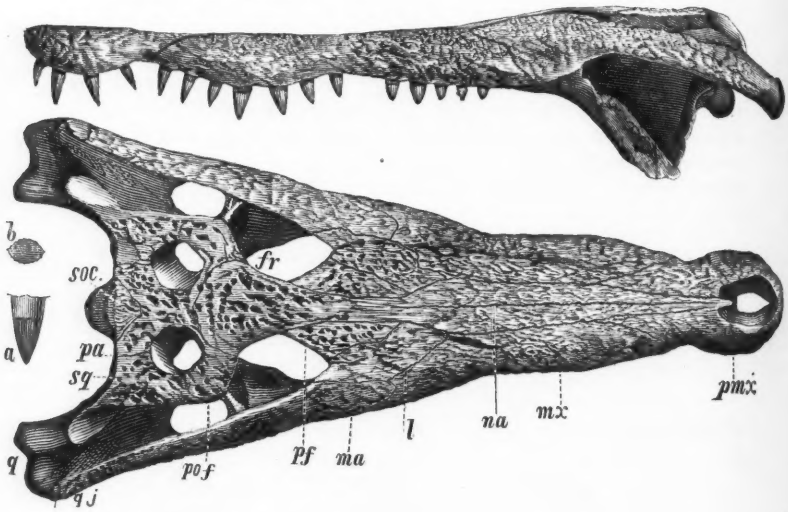


FIG. 3.—Skull of *Crocodilus acer* Cope, from Utah, nearly one-third natural size, lateral and superior views. FIGS. *a* and *b*.—Lateral view and section of a maxillary tooth. *Pmx*, premaxillary bone; *mx*, maxillary; *na*, nasal; *l*, lachrymal; *pf*, prefrontal; *ma*, malar; *fr*, frontal; *pof*, post-frontal; *pa*, parietal; *soc*, supraoccipital; *sq*, squamosal; *q*, quadrate; *qj*, quadratojugal. (Original.)

CROCODILIA.

The fauna of the Eocene periods of the United States included a number of species of *Crocodilia*, some of which were represented by great numbers of individuals. They were equally numerous in the Wasatch and Bridger epochs, but none have been found in the Green River formation proper. They are moderately abundant in the Wind River beds, and a species is

known from the Manti beds of Utah. None are known from the Miocene formations east or west of the Rocky mountains, but they are not rare in the marine Miocene of the Atlantic coast. All the species belong to two genera, *Plerodon* Meyer, and *Crocodilus* Linn. One species of the former is found in the Wasatch beds, with three or four species of *Crocodilus*. In the Bridger beds I know of six species of the latter genus.

It is a fact that the American genus *Alligator* is nowhere found in the Tertiary formations of our continent. It is evident that it is a specialized form of *Crocodilus*, which first appeared in Europe in Tertiary times, and subsequently in this country.

CROCODILUS Linn.

The Eocene species of true crocodiles differ much in size and characters, ranging from the *C. heterodon*, which is not larger than an *Iguana*, to the *C. antiquus* and *C. clavis*, which rival the existing species of the East Indies.

The species are divided into two sections, which are distinguished by the form of the frontal bone. In the one it is thin, and has low lateral olfactory crests. Such species are as yet only known from the Wasatch formation. They are the *C. grypus* Cope and *C. wheeleri* Cope. The species of the second section have massive frontal bones with strong lateral olfactory crests. The *C. heterodon* of the Wasatch belongs here; also the *C. elliottii* of the Bridger, and the *C. clavis* of the Washakie basin. The frontal bones of several of the species are unknown. The species may be also distinguished by the sculpture of their teeth, some having the crowns grooved or channeled, and others having them smooth or finely lined. Of the former kind are *C. subulatus* Cope, *C. acer* Cope and *C. sulciferus* Cope; all the other species come under the second head. The *C. squankensis* Marsh, from the Eocene of New Jersey has the enamel peculiarly rugose. A peculiarity of the composition of the crowns of some of the species has been noticed, on account of which I proposed a genus, *Thecachampsa*. In this type the crown is composed of concentric hollow cones, one within the other. I have not been able to separate the crowns of the recent crocodiles into such bodies, and they are generally too thin to display more than a very few such layers, were they so separable. This character was first observed in some species of the Atlantic Coast, *e. g.*, *C. antiquus* Leidy, and

C. squankensis Marsh; and the two Eastern Miocene species, *C. sericodon* Cope (type of *Thecachampsa*) and *C. sicaria* Cope.

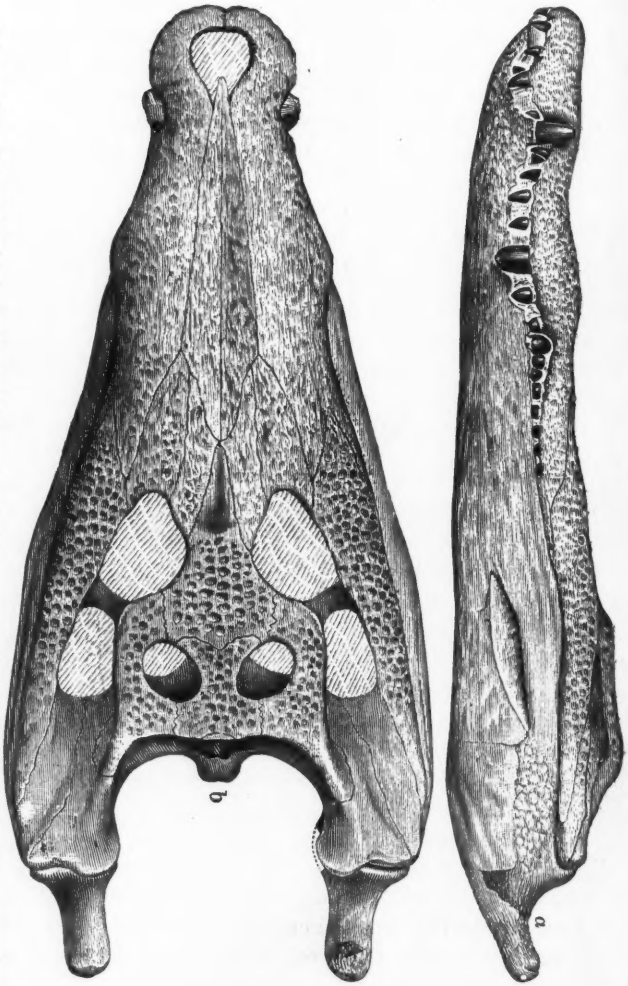


FIG. 4.—*Crocodilus affinis* Marsh, from Wyoming, nearly one-third natural size, lateral and vertical views. (Original.)

The forms of the crowns vary considerably. In nearly all Crocodilia the posterior teeth have short and obtuse crowns; but in *C. heterodon* Cope, this character is carried very far. The

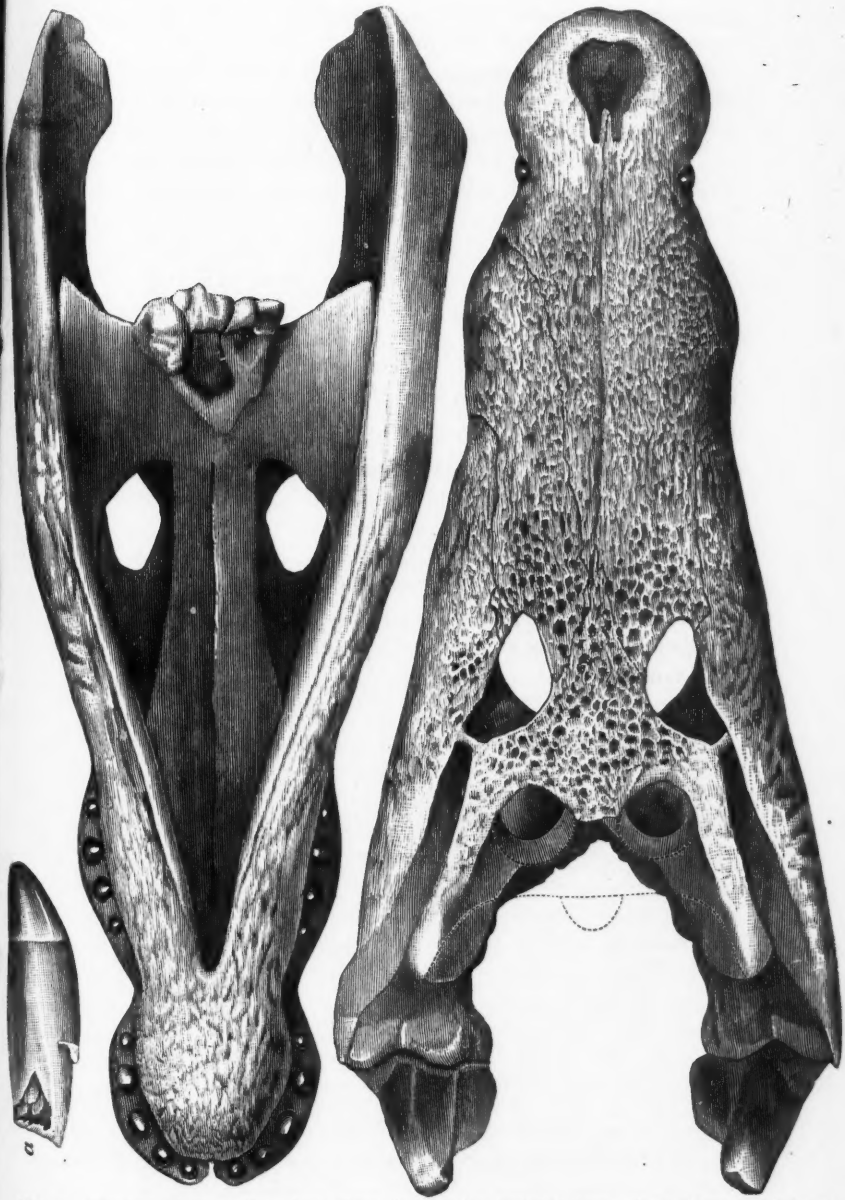


FIG. 5.—Cranium of *Crocodilus clavis* Cope, lacking the occipital bones, from above and below, less than one-eighth natural size. *a*.—A maxillary tooth, one-half natural size. (Original.)

posterior crowns are oval, bean-like bodies, with a median line from which fine incised lines radiate.

Species with obtusely conic crowns are *C. antiquus* Leidy; *C. clavis* Cope; *C. elliottii* Leidy; and *C. affinis* Marsh. *C. subulatus* Cope has the crowns acutely conic and curved or straight, while in *C. acer* Cope, they are compressed and have cutting edges. Finally, in *C. xiphodon* Marsh, they are much compressed and sharp-edged.

The *Crocodilus (Thecachampsa) serratus* Cope, of the New Jersey Eocene, presents the remarkable peculiarity of a finely serrate ridge along the middle line of the front and back of the neural spines of the vertebræ.

In *C. heterodon* the osseous scuta of the back are articulated together by suture, as in some of the alligators.

PLERODON Meyer.

This genus only differs from *Crocodilus* in the presence of two large teeth in each jaw in the position usually occupied by the single so-called canine tooth. It includes the *P. rateli*, an abundant species in the French Miocene. I detected a species in the Wasatch formation of New Mexico, the *P. sphenops* Cope. It is about the size of the alligator, and has a narrow muzzle.

The following list shows the distribution of the Eocene crocodiles now known:

Puerco epoch. Three species undetermined.

Wasatch epoch. *Crocodilus wheeleri, C. grypus, C. heterodon, C. acer.*

Bridger epoch. *C. subulatus; C. sulciferus; C. xiphodon; C. polyodon; C. affinis; C. elliotti; C. clavis.*

Claiborne epoch (marine). *C. antiquus; C. fastigiatus; C. squankensis; C. serratus.*

In general characters, so far as known, there is considerable resemblance between the Eocene and existing species of *Crocodilus*. The *C. acer*, for instance, resembles in the form of its skull the *C. americanus*, of the West Indies and Mexico, but differs in the absence of the strong convexity of the frontal bone, and the more strongly grooved teeth. In general, the recent species have more pronounced cranial ridges than those of the Eocene period.

TESTUDINATA.

The Eocene forms of this order are of unusual interest. I have seen sixteen species from the Wasatch formation, and thirty-two

from the Bridger and Washakie. Of these, six are common to the two formations, as indicated by imperfect material, leaving a total of forty-two. Three genera, *Emys*, *Trionyx*, and *? Plastomenus* hold over from the Cretaceous period, while six appear for the first time. Of these, five genera are not known to continue later than the Eocene period. In order to understand their relation to members of the order which lived in other periods, I give a general sketch of the classification of the *Testudinata*.

Three primary divisions of this order are generally recognized. The first of these, the *Athecæ*, includes one living and one extinct genus. It is characterized by the absence of the combined coössification of ribs and skin, which form the carapace of other tortoises, and by the annular shape of the inferior shell or plastron, which has no connection with any other part of the skeleton. In the recent genus *Sphargis* (the leather-back turtle), the skin is filled with small osseous plates, which form by their union a dorsal shield.

The other two suborders have the usual carapace and plastron, but they differ in some curious particulars. The greater number of the tortoises of the southern hemisphere cannot draw their heads into their shells, but throw them round sideways when they wish to protect themselves. As if to compensate for this defect, they have the pelvis united by suture below to the plastron, which insures strength but not elasticity. Then they have a peculiar frontal bone, and an additional scutum of the front of the plastron. This group is called the *Pleurodira*. In North America its species are only known as fossils of the Cretaceous period, and will therefore not be further mentioned here. The group which has characterized the Northern Hemisphere since the beginning of Tertiary time, although some of its members appeared earlier, is the third division of tortoises, the *Cryptodira* of Duméril and Bibron. They draw the head within the shell by a sigmoid flexure of the cervical vertebræ; the pelvis is not coössified with the plastron; the frontal bone reaches the palatine below, and there is no additional scutum of the plastron.

Three prominent divisions or tribes may be recognized among the *Cryptodira*, by the various modes of articulation of the plastron with the carapace. In the first, the breast-plate sends out a few digitations to the edge of the dorsal shield on each side,

but forms no true union with it. These are the *Dactylosterna*.[1] The species are all aquatic, and many of them of marine habitat; they are the least specialized of the order, after the *Athecæ*. In the second tribe or *Clidosterna*, the plastron and carapace are united by a close suture at their edges of contact between the positions of the fore and hind legs; and the plastron in addition, sends upwards, at the armpit and groin, on the inner side of the carapace, a process or abutment, which gives great strength to the union. In this division belong the fluviatile and many land

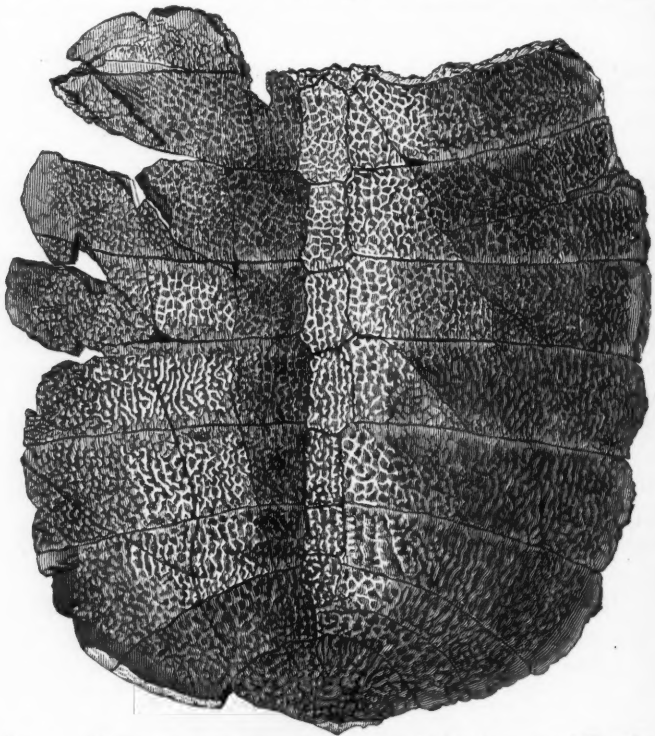


FIG. 6.—*Trionyx scutumantiquum* Cope, from the Bridger formation of Wyoming, one-fourth natural size. (Original.)

tortoises. The third division, or *Lysosterna*, is less abundantly represented by species than the other two. The plastron and carapace are closely joined, but not by suture. Their straight

[1] See Proc. Amer. Philos. Society, 1881, p. 143.

applied edges are separated by a thin layer of cartilage only, and there are no buttresses to strengthen the union. These are the tortoises which close the shell partially or wholly, by a hinge across the middle of the plastron; and they are exclusively inhabitants of the land.

The families of the *Dactylosterna* are the marine turtles (*Chelonïidæ*), the snappers, (*Chelydridæ*), a family which connects the two, (*Propleuridæ*), and the *Trionychidæ* or soft-shelled turtles. The *Propleuridæ* belong to the cretaceous beds only, but the others abound in the Tertiaries.

In the marine Eocene of New Jersey, parts of huge turtles are found, but enough is not yet known of them to assure us to

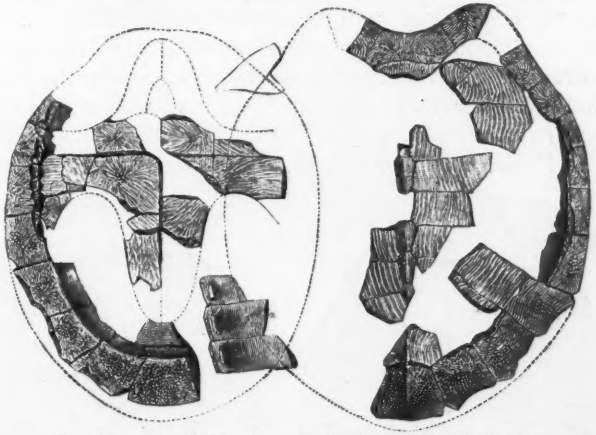


FIG. 7.—*Anostira ornata* Leidy, from the Bridger beds of Wyoming, one-half natural size, superior and inferior views, with section of marginal bone. From Leidy.

what family they belong, except that they are not *Trionychidæ*. The sutures of their shells are very deeply interlocking and splintery. They form the genus *Lembonax* Cope.

In the lacustrine Tertiaries of the West the only families of *Dactylosterna* represented are the *Trionychidæ* and *Chelydridæ*. Although found in the Western rivers at the present time, the *Trionychidæ* are only represented in a fossil state in the Eocene beds. They are unknown in the Miocene of the West, though common in the marine Miocenes of the coast. Species of *Trionyx* are very abundant in the Wasatch and Bridger beds, one of which is represented in the wood cut, Fig. 6. One genus of *Chelydridæ*

occurs in the Bridger formation, the *Anostira* of Leidy (Fig. 7). Its two species differ from the existing snappers in having the marginal bones of the carapace united by suture with the plastron, in which they resemble *Clidosterna*, and in being elegantly sculptured as in the *Trionychidæ*.

The *Clidosterna* are represented by three families, the *Baënidæ*, the *Emydidæ*, and the *Testudinidæ*. The first named family is of much interest, as it displays marked points of resemblance with the *Pleurodira* and the *Chelydridæ*, as well as with *Emydidæ*. Like the first named, it has the additional scuta of the plastron (integulars); like the second, it has the caudal vertebræ concave behind instead of in front, and has an additional row of scuta on the plastron, in contact with the marginals of the carapace. Then it has an additional bone on each side of the plastron (intersternal) as in *Pleurodira*. This family appeared in Europe in the Jurassic period (*Platychelys*), and has been found in the American Laramie Cretaceous (*Polythorax* Cope). In the Eocene we have the genus *Baëna* Leidy, with four species, one of which is figured below

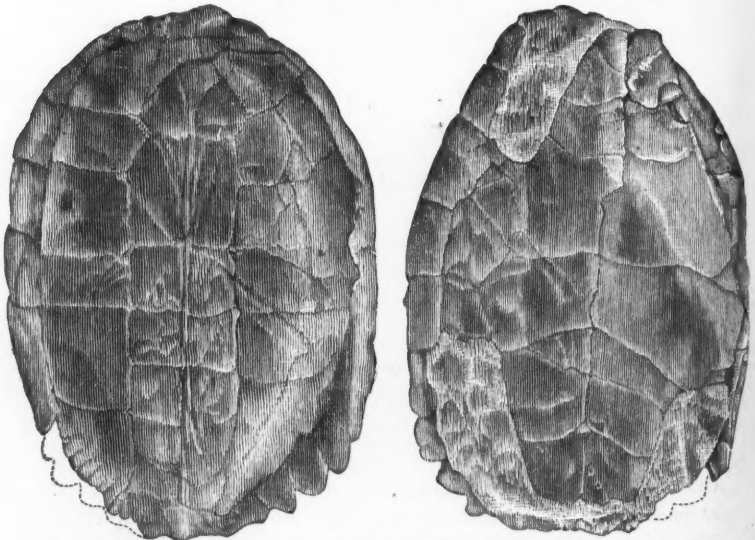


FIG. 8.—*Baëna arenosa* Leidy, from the Bridger beds of Wyoming, one-third natural size. (Original.)

(Fig. 8). Species of *Baëna* range from the size of a red belly (*B. arenosa*) to that of a loggerhead (*B. hebraïca*). The genus is only known in the Wasatch and Bridger.

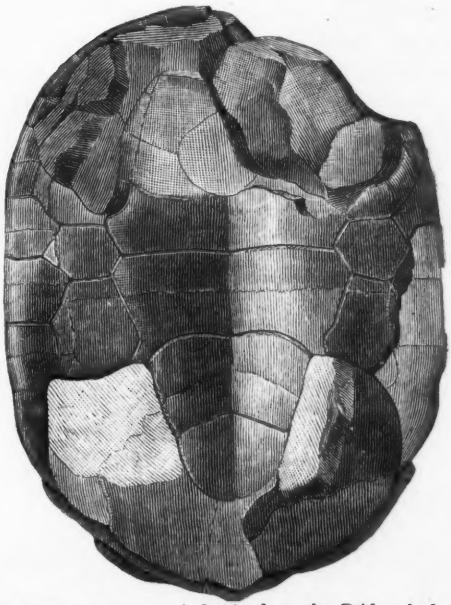


FIG. 9.—*Dermatemys wyomingensis* Leidy, from the Bridger beds of Wyoming. (From Leidy.)

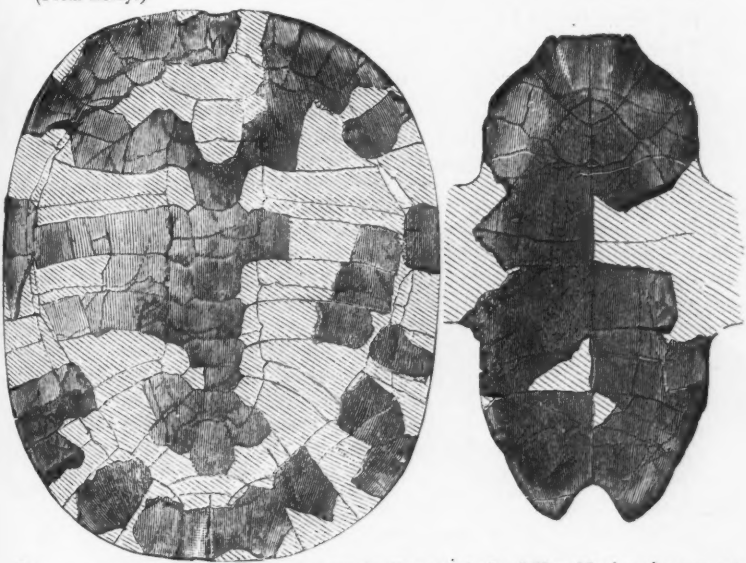


FIG. 10.—*Emys lativertebralis* Cope, from the Wasatch beds of New Mexico, the carapace from above and the plastron from below, one-third natural size. (Original, from Report of Wheeler's Survey, Vol. IV.)

The *Emydidæ* abound in the Eocene beds, and continue in greatly reduced numbers through the Miocene to the present time. But two genera occur in the Eocenes, *Dermatemys* and *Emys*, and these still exist. *Dermatemys* is known by two species, one from the Wasatch, and one from the Bridger (Fig. 9), and by two or three living species from Mexico and Central America. These tortoises have the general appearance of the *Baënæ*, in their narrowed sternal lobes, but they lack the essential characters of that genus, except the intermarginal row of scuta on the sides of the plastron. There are many species of *Emys* in all the Eocene beds. They are all nearly smooth, and of medium size, Fig. 10 represents one of them from the Wasatch bed of New Mexico. Its bones are light and thin; those of *E. shaugnessiana* Cope, are very thick. The surface of *E. septaria* Cope, from the Washakie basin, has delicate radiating lines.

A number of elegantly sculptured species, some of which are of small size, occur in the lacustrine Eocenes. They belong to the genus *Plastomenus* Cope, and they are not yet sufficiently well known to make it clear whether they are *Emydidæ* or not.

One genus of *Testudinidæ* ranges through our Eocenes. This is *Hadrianus* Cope, which only differs from *Testudo* in having two anal scuta instead of one, so far as the carapace is concerned. There are, perhaps, three species, two of which, *H. corsoni* and *H. octonarius*, grow to a large size (Fig. 11–13). They were heavy animals, and represent the earliest of the huge land tortoises of the genus *Testudo*, which still people the Gallapagos and Mascarene islands of the Pacific ocean.

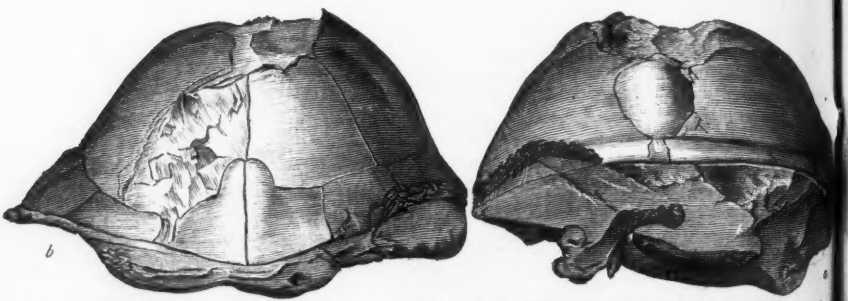


FIG. 11.—*Hadrianus octonarius* Cope, from the Bridger bed of Wyoming, one-eighth natural size extremities *a* anterior, *b* posterior.

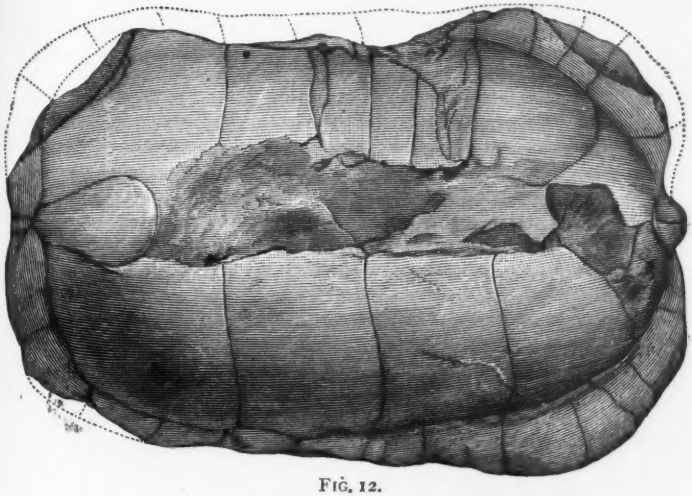
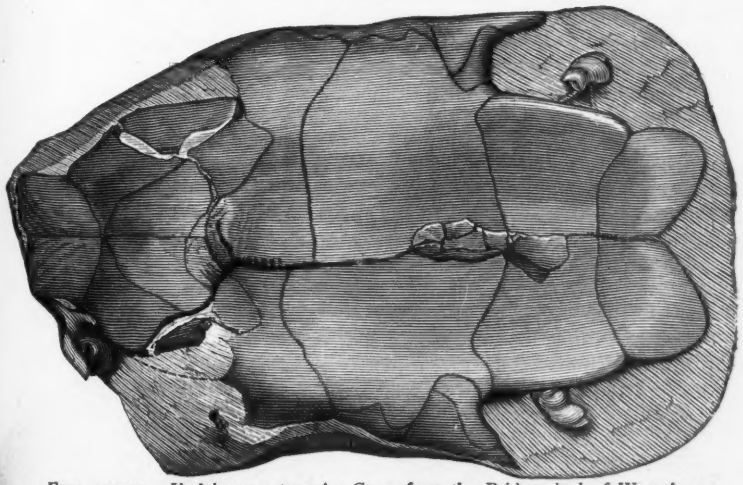


FIG. 12.



FIGS. 12–13.—*Hadrianus octonarius* Cope, from the Bridger bed of Wyoming. Fig. 12.—Superior view. Fig. 13.—Inferior view, one-eighth natural size.

The whole number of species of reptiles thus far discovered in the Eocene of North America, is as follows:

Crocodilia	18
Testudinata	42
Lacertilia	25
Ophidia	6
	91

EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

——The question of the admission of women to our universities periodically agitates the controllers of those institutions, as new sets of female aspirants present themselves. This will no doubt go on until women have the same opportunities as men for higher education. The reasons why they should not enter the universities, as presented by those who oppose their claims, do not appear to us to possess much weight. The diversity of the objections is curious. On the one hand, we are told that the inferiority of the sex is such that university advantages are useless to them. Others insist that the superiority of women is so great that they should not be exposed to the vicissitudes of the student life. Some are afraid of "unsexing" them; others fear that they will be unfitted for the duties of domestic life.

We believe these estimates of woman's character to be mistaken, and the fears to which they give rise to be groundless. The relative position of the female sex was fixed before the origin of mankind, and it will not be readily changed in any material respect. When there is a prospect of changing the anatomy and physiology of woman, the possibility of "unsexing" her will present itself, and not sooner. It is the ignorance of this fact that gives rise to much of the solicitude which we hear expressed. There are a few abnormal individuals of each sex, whose sex characters are not pronounced, but this irregularity is very apt to right itself in a second generation, if any there be. For the mass of both sexes the obvious necessity is to make the most of them, intellectually, affectionally, and physically. The policy towards woman has too often been to dwarf them in one or all of these respects. In the East the physical and emotional are encouraged, and the intellectual is suppressed. In the West the physical is discouraged, shall the intellectual be so also? To suppress the intellectual development of woman, argues ignorance of his own position on the part of man. This ignorance gives rise to unmanly fear, and to injustice to his own children, and to the race. Women cannot be too highly developed, and the mind cannot be omitted from a true development. As men are the sons of women, they lose nothing by the education of their mothers. Compulsory education is quite as much needed for women as for men, and good results might be anticipated were it applied.

There are some objections to coeducation, but they are more than counterbalanced by the necessities of the case. It is true that women attain maturity earlier than men; hence they frequently outstrip male students in college and university competition. Were the competition postponed a decade in the lives of each, the results would generally be different. In fact, the objection is not a serious one, for the girls may be classed at school with older boys, as they are to be with older men in later years. If girls and women are to have university education, they must share it with men, for there cannot be two sets of buildings and two faculties for the two sexes, where one will do the work.

A different class of objections is raised from the supposed risks to propriety and morality incident to the association of the sexes in a large educational institution. As university students are generally supposed to be beyond the age of tutelage, these objections are not more applicable than to single women in other walks of life. Those who have had a proper home education are not likely to give ground of complaint, and those who have not received such training, are not likely to do better by exclusion from university education. On the contrary, such education must give them a better knowledge of men and their relations to them. And the more that is known of the facts of this question by both sexes, the better. They will discover that there are boundaries set by natural law, beyond which neither sex can pass without suffering of body or mind; and that in this, as in every other relation of life, "honesty is the best policy."

Finally, women should have university education to open to them additional avenues for obtaining a livelihood. Those who oppose it are unwittingly sustaining the too large numbers of prostitutes, incapable wives, and under-paid working women.—*C.*

—— The *Atlantic Monthly* for October has an excellent article, by Mr. Hewett, on the administration of universities. It shows what has long been obvious, that the existing American system is a bad one, and that its faults are chiefly due to the fact that the faculties have no share in the government of our great schools. Mr. Hewett points out the self-evident fact that the persons best adapted for the management of educational institutions, are practical educators, *i. e.*, professors and teachers. We hope that trustees and incorporators of our universities will more and more see the necessity of selecting their new members from this class, so that in time something more like the German system may prevail in America.

—— In criticising, in our last number, the determination of the Mammalia, said by Professor Whitney to have been found accompanying the Calaveras skull, we do not wish to be understood as doubting the determination of the age of the skull itself. There is good reason for believing that skull to have been buried at the period of the deposition of the gold-bearing gravel, in which it is said to have been found.

RECENT LITERATURE.

LANKESTER ON DEGENERATION.[1]—Mention should have sooner been made of this book, which, with the previously published essay by Dr. Anton Dohrn,[2] draws attention to a phase of development, which has been somewhat neglected of late years; although the French naturalists a generation ago had a good deal to say about arrest of development, retrograde development and retrograde metamorphosis. The author recognizes the fact that there are numerous and important exceptions to the general law of progressive development, that some important groups are due to retrogressive development, or to put it into one word, Degeneration. Lankester explains what he means by degeneration thus: The lizard-like creature Seps has remarkably small limbs, and in Bipes there is only a pair of stumps, representing the hinder limbs. No naturalist, he says, doubts that Seps and Bipes represent two stages of degeneration, or atrophy of the limbs; that they have, in fact, been derived from the five-toed, four-legged ordinary lizard form, and have nearly or almost *lost* the legs once possessed by their ancestors.

"This very partial or local atrophy is not, however, that to which I refer when using the word Degeneration. Let us imagine this atrophy to extend to a variety of important organs, so that not only the legs, but the organs of sense, the nervous system, and even the mouth and digestive organs are obliterated,—then we shall have pictured a thorough-going instance of Degeneration."

The examples of degeneration given by the author need only to be mentioned, as they are sufficiently striking, and are universally regarded as such. These are the groups of which Sacculina and Peltogaster, Lernæa and Lepas are examples. The Ascidians are regarded as the result of such a process, and their most important stages of degeneration are represented and briefly discussed, though the figure of the larval Ascidian side by side with the tadpole, on p. 42, is greatly exaggerated, *a la* Haeckel, and is misleading to the lay-reader. The author also speaks of the Ascidians as if they were universally regarded by zoölogists as Vertebrates, whereas they are regarded as Mollusks by some, and as worms by many.

The author considers the antecedents of degeneration to be[3]: 1. Parasitism; 2. Fixity or immobility; 3. Vegetative nutrition; 4. Excessive reduction in size.

Lankester also regards the sponges as due to degeneration, and "as only somewhat less degenerate we have all the Polyps and

[1] *Nature Series. Degeneration.* A chapter in Darwinism. By Professor E. RAY LANKESTER, F. R. S. London: Macmillan & Co., 1880. 12mo, pp. 75. Price, 75 cents.

[2] Der Ursprung der Wirbelthiere und das Princip des Fanctionswechsels. Genealogische Skizzen von Anton Dohrn. Leipzig, 1875. 8vo, p. 87.

[3] See also Cope, Consciousness in Evolution, 1875, and Modern Doctrine of Evolution, AMER. NATURALIST, 1880, 266.

Coral-animals; also the Starfishes." He regards the Lamellibranchiate mollusks as having degenerated from a higher type of head bearing active creatures like the cuttle-fish. The Polyzoa he appears to regard as degenerate mollusks, and the Rotifers as having degenerated from forms provided with legs.

The author then claims that certain human races are degenerated descendants of higher, more civilized peoples; such as the present descendants of the Indians of Central America, the modern Egyptians, "and even the heirs of the great Oriental monarchies of prae-Christian times," while the Fuegians, the Bushmen, and even the Australians may also be degenerate races. Thus while he is indisposed to regard all the human races as degenerated from an early high type of mankind, he recognizes the fact that numerous races have fallen away from a higher stage.

We are inclined to think that the examples of degeneration mentioned by the author are really such. There are other examples not referred to by Professor Lankester, such as the lice and Mallophaga, which are degenerate Hemiptera. Among the Diptera are numerous wingless degraded forms, and when we take into account the fact that nearly all Dipterous larvæ are nearly headless and evidently degenerated forms, we are inclined to think that the entire group of Diptera, numbering at least 20,000 species, are the result of a retrograde development; the Tipulidæ may be an exception, but we were before reading this book disposed to regard the entire order as having degenerated from a lost type, with close affinities to the lower Lepidoptera.

GEIKIE'S PHYSICAL GEOGRAPHY.[1]—Professor Geikie, the author of this little book, formerly held the chair of geology in the University of Edinburgh, but is now director of the Geological Survey of Great Britain. As an authoritative text book this publication, therefore, needs from us no recommendation; but besides that, it is written in a clear, graphic, attractive style, and the matter is well arranged. We have found the book more useful for teaching purposes than any other. It full enough and readable enough to attract and win the scholar's attention. There are some, though but few, points which in a subsequent edition might be revised; to the *Challenger's* soundings in the Pacific ocean might be added the results of the U. S. steamer *Tuscarora*, from San Francisco to Honolulu and Japan, also the results of the U. S. Coast Survey soundings in the Caribbean sea, and the origin and depth off Florida of the Gulf Stream, The author has devoted more space than is usual in similar class-books to the phenomena of the atmosphere, but the treatment of the whole subject is throughout broad and catholic.

[1] *Elementary Lessons in Physical Geography.* By ARCHIBALD GEIKIE, LL.D., F.R.S. Illustrated with wood-cuts and ten plates. London and New York, Macmillan & Co., 1881. 12mo, pp. 375. $1.

GEIKIE'S GEOLOGICAL SKETCHES.[1]—This collection of essays, by one of the foremost geologists of the day, not only contains some matter of purely geological interest, but will serve, by the genial spirit and clear, attractive literary style of the author to attract the notice of that large and increasing class in the community—our general readers. The study of geology has gained new interest and fascination in these latter days in connection with biological questions, and from the fact that no tourist can travel through a land and appreciate the nature of its people, without taking into account the qualities of the soil they inhabit. While writerst like Buckle and perhaps Taine have carried to an extreme the independence of man and nature, overlooking the social and moral forces, as well as the laws of heredity; how dependant the making of a people like the English, for example, has been upon the physical geology of Great Britain is well brought out by Professor Geikie in the closing sketch of this book—a chapter which will, perhaps, interest the thoughtful reader as much as any in the book.

Again, fresh attention is being called, especially by some American and Canadian geologists, to the pervasive and powerful agency of so simple a geological agent as rain in eroding lake basins and river valleys; this hitherto not sufficiently appreciated agent having been kept too much in the background by extreme glacialists. The effect on the mind of so good and fair an observer as our author, of the results of atmospheric erosion in the volcanic region of Auvergne in France, bears the strongest and clearest testimony to the past as well as present intensity of pluvial forces, which have done nearly, if not quite as much as plutonic agencies in making our earth what it is.

But none the less is Professor Geikie on proper occasions, a staunch glacialist, and in the interesting record of his Norwegian journeys, we have fresh confirmation by an expert, of the well-grounded theory that laid ice once capped Scandinavia as well as Scotland, the present representatives being but pigmies compared with the former rivers of ice, which filled and remolded, aided by subglacial streams, the valleys of Northwestern Europe.

In the essay on rock-weathering we have further evidence that it will not do to build public structures of freestone or marble in northern countries like Great Britain or the Northern United States.

Professor Geikie's record of his rapid journey to Montana and the Yellowstone Park, which have been widely read and appreciated, find here a place of permanent preservation, and the stimulus of foreign observation and travel in the mind of one brought up in so small and isolated a geological area as the British Isles,

[1] *Geological Sketches at Home and Abroad.* By ARCHIBALD GEIKIE, LL.D., F.R.S. Director General of the Geological Surveys of the United Kingdom, with illustrations. New York, Macmillan & Co., 1882. 12mo, pp. 332.

is perceptible in the succeeding chapter on the lava fields of Northwestern Europe.

TREAT'S INJURIOUS INSECTS OF THE FARM AND GARDEN.[1]—One of the most hopeful signs of improvement in agriculture is the increased attention that is paid to injurious insects, the depredations of which have for many years attracted attention from entomologists, have at length forced themselves upon the notice of legislatures, and are now at last beginning to awaken the agricultural mind to the importance of the study of the life-history of the pests, with a view to combating them. In the words of the author, "There is a surprising lack of knowledge among otherwise well-educated people as to the life-history of even the most common insects. The question asked not only by those in my immediate neighborhood, but by letters from all parts of the country, show how slight is the popular knowledge on this most important branch of Natural History." Too true—even a non-entomologist finds himself surprised at the vastness of the ignorance, yet the mere asking questions is a great advance upon the state of mind that referred a plague of caterpillars to the providence of God.

In the two hundred and eighty pages of this little book all those insects that have developed into conspicuous pests are figured and described in terms sufficiently simple for the comprehension of any reader who is able to discriminate an insect from a spider or a myriapod, or the orders of insects from each other. That readers in search of knowledge may be without excuse, the author prefaces her work with information on the above essential points.

The subject is dealt with under the heads of, Insects injurious to Garden Vegetables; Insects injurious to Root Crops and Indian Corn; Insects injurious to Cereal Grains and the Grass Crops, including Clover; Insects injurious to Fruit Trees; Insects injurious to Small Fruits, and Insects of the Flower Garden and Greenhouse. In many cases methods of extermination or at least of palliation, that have previously proved successful are detailed, but, as is remarked with respect to the pea-weevil, in order to exterminate an insect from a district it is necessary that agriculture shall have progressed to such a point that all the farmers of a district shall mutually agree to carry out the proper measures in unison; in the case of the last-mentioned insect, such a result would be arrived at were all to cease the cultivation of peas for a simple year—a cheap price for the benefit accruing.

Among facts not very widely known are the destruction wrought among cabbages, by *Plusia brassicæ*, Riley; and that caused on parsley, carrot, and other cultivated umbellifers by the

[1] *Injurious Insects of the Farm and Garden.* By MARY TREAT. Fully illustrated. New York, Orange Judd Co., 751 Broadway. 1882.

green, black-and-yellow-spotted caterpillers of the beautiful black yellow-spotted swallow-tail butterfly.

The Lepidoptera and Coleoptera take the lead in the number of destructive species, and it is hard to say which works most damage, as most of our cultivated plants appear to have enemies in both ranks, though the potato and sweet-potato are especially affected by beetles, and the cabbage and fruit-trees generally, by caterpillars. The Hemiptera, with Phylloxera, the Chinch-bug and the aphides, come next in destructive powers; the Diptera contribute several species, the Hymenoptera, though principally beneficial to man, furnish him with saw-fly enemies; and the one destructive locust enumerated is a host in himself. The work is printed in clear type and forms in all respects an attractive volume. —*W. N. L.*

U. S. Fish Commission Report for 1879.—This stout volume is full of good material, whether piscicultural or zoölogical or botanical. Several excellent papers, purely scientific and yet of value in the connection in which they appear, are sandwiched in between the commissioner's own report and the chapters relating to fish-culture. The most important of these, and abundantly illustrated with excellent wood-cuts, are Professor W. G. Farlow's Marine Algæ of New England, and Professor A. E. Verrill's report on the Cephalopods of the north-eastern coast of America. A large proportion of the volume is devoted to translations from European authors, which will undoubtedly prove useful to pisciculturists in this country, though there are chapters by H. W. Mason, Livingston Stone and Charles G. Atkins on the propagation of salmon. These reports are doing great good in both a practical and scientific direction.

Recent Books and Pamphlets.—A system of Human Anatomy, including its medical and surgical relations. By Harrison Allen, M.D. Section I. Histology, by E. O. Shakspeare, M.D. Section II. Bones and Joints, by H. Allen, M.D. Philadelphia, 1882. From the author.

United States Commission of Fish and Fisheries. Report of the Commissioner for 1879. Washington, 1882. From the department.

The Mungoose on sugar estates in the West Indies. By D. Morris, M.A. Kingston, Jamaica, 1882. From the author.

Official Report on the Creston group of mines in the State of Durango, Mexico. By Professor Adolphe Rock. Philadelphia, 1882.

On Fishes Tails. By E. T. Newton, F.G.S. Reprint from the Journal of the Quekett Microscopical Club. London, 1882. From the author.

Camps in the Caribbees. The adventures of a naturalist in the Lesser Antilles. By Fred'k A. Ober. Boston, 1880.

Thèses présentées a la Faculté des Sciences de Lille, Université de France, pour obtenir le grade de Docteur ès Sciences Naturelles. Par Persifor Frazer, A.M., de Philadelphie. 1re Thèse: Memoire sur la Geologie de la parti sud-est de la Pennsylvanie. 2me Thèse: Propositions donneés par la Fuculte. Lille, 1882. From the author.

Report of Proceedings of the National Academy of Sciences, from Nov. 16, 1880, to the close of the year 1881.

National Academy of Sciences, Constitution and Membership. Washington, 1882. From the society.

Cacao: How tó Grow and how to Cure it. By D. Morris. M.A. Kingston, Jamaica, 1882. From the author.

Uber eine neue Eremias-Art aus dem Thal des Krododil-flusses in Transvaal. Von Dr. Franz Steindachner. Aus dem LXXXV Bande der Sitzb. der k. Akad. der Wissensch., I Abth., 1882. From the author.

Batrachiologische Beiträge. Von Dr. Franz Steindachner. Aus dem LXXXV Bande der Sitzb. der k. Akad. der Wissensch., 1882. From the author.

The Channel Tunnel. By Professor Boyd Dawkins, M.A. Ext. from the Trans. Manchester Geological Society, 1882. From the author.

The American Journal of Forestry. Edited by Franklin B. Hough. Cincinnati, Oct., 1882. From the editor.

Notice sur les espéces du genre Philothamnus, qui se trouvent au Muséum de Lisbonne. Par J. V. Barboza de Bocage; also, by the same author: Aves das possessões portuguezas da Africa occidental; and Liste des Mammifères envoyés de Caconda (Angola) par M. D'Anchieta. Extracto de Jornal de Sciencias Mathematicas, Physicas e Naturaes, Nº XXXIII. Lisboa, 1882. From the author.

Descriptions of ten new species of Monticulipora from the Cincinnati group, Ohio. Index, etc. By U. P. James. Cincinnati, 1882. From the author.

Jamaica. Annual Report of the Public Gardens and Plantations for the year ending 30th Sept., 1881. By D. Morris, director. Kingston, Jamaica, 1882. From the author.

Beiträge zur Palāontologie Osterreich-Ungarns, und des Orients, herausgegeben Von E. v. Mojsisovics und M. Neumayr. Wien, 1882. Der jungtertiäre Fischfauna Croatiens. Von Drag. Kramberger-Gorjanovic. Beiträge zur Kenntniss der fossilen Diatomeen Osterreich-Ungarns. Von A. Grunow.

Brief mention of some of the men who aided in developing the science of geology in America. Descriptions of three new species of fossils, and remarks upon others. By S. A. Miller. Description of a new species of Bourguetocrinus. By P. de Loriol, etc., etc. From the Jour. Cin. Soc. Nat. Hist., Oct., 1882. From S. A. Miller.

——:o:——

GENERAL NOTES.

BOTANY.[1]

NEW SPECIES OF NORTH AMERICAN FUNGI.—*Diplodia Pyri* E. and M.—Spots, light brown, small, border nearly obsolete; perithecia black, scattered, mostly epiphyllous; spores oval, brown, 24–25×9–12 μ. On living lvs. of *Pyrus malus*. Newfield, N. J., Sept., 1882.

Septoria Silenes E. and M.—Spots small, light yellow; perithecia brownish-yellow, soft, innate, scattered, 56 μ. diam.; spores yellowish, cylindrical, curved, triseptate, 48 × 3 μ. On living leaves of *Silene stellata*, Chester Co, Pa. Dr. Martin.

Septoria psilostega E. and M.—Spots golden yellow, mostly occupying the margin of the leaf; perithecia hypophyllous, scattered, yellow, very delicate, exuding a mass of amber colored spores which viewed separately are subhyaline, filiform, straight or curved, faintly triseptate, 60×3 μ. On lvs. of *Galium pilosum*.

Septoria Smilacinæ E. and M.—Spots gray, oblong, border broad, dark-pink; perithecia light-brown, conoid, mostly epiphyl-

[1]Edited by PROF. C. E. BESSEY, Ames, Iowa.

lous, 114×3 μ.; spores hyaline, filiform, guttulate, 63–114 × 3 μ. On lvs. of *Smilacina*, Chester Co., Pa. July, 1882.

Septoria Symploci E. and M.—Spots white, 1-1½mm diam. border brown and a little raised; perithecia brown, subglobose, hypophyllous, semi-immersed, scattered irregularly, 112 μ. diam.; spores hyaline, cylindric-clavate, spuriously 2–3 septate, curved, 24–30 × 3 μ. On fading leaves of *Symplocos tinctoria*. Green Cove Springs, Fla., Feb., 1882. Dr. Martin. Differs from *S. stigma* B. and C. in its longer spores.

Septoria lepidiicola E. and M.—Spots pallid, subregular, ¾mm diam., perithecia dark-chestnut color, crowded, 74 μ diam. spores hyaline, cylindrical, slightly curved, ends obtuse, guttulate or septate, 24–33 × 2½–3 μ. On living leaves of *Lepidium Virginicum*. W. Chester, Pa., June, 1882. *S. Lepidii* Desm. has ovate spores 6–8 × 4–6 μ.

Septoria lactucicola E. and M.—Perithecia punctiform, minute, scattered on brown, concentrically wrinkled spots, ½-1½ centim. diam. spores filiform, mostly curved 25–30 μ. long. On living lvs. of *Lactuca Canadensis*. Newfield, N. J., Sept., 1882. Quite different from *S. Lactucæ* Pass.

Phyllosticta clethricola E. and M.—Perithecia amphigenous, erumpent, on pale-brown spots 2–10mm diam. Spores subhyaline, guttulate, ovate 9 × 6 μ. On lvs. of *Clethra alnifolia*. Newfield, N. J., Sept., 1882.

Phyllosticta bataticola E. and M.—Perithecia few, minute, black, on small, white, round spots with a purplish border; spores oblong-elliptical 5 × 2 μ. On lvs. of *Batatas edulus*. Newfield, N. J., Sept., 1882. *S. Batatas* Cke. has larger brown perithecia on much larger spots and has rather larger spores.

Phyllosticta Orontii E. and M.—Perithecia brown, epiphyllous, 56 μ. diam. on large yellow spots with an indefinite border; spores ovate, 6 × 2½ μ. On lvs. of *Orontium aquaticum*.

Phyllosticta iolani E. and M.—Spots light-brown, border a little darker; perithecia black, innate, amphigenous, upper portion deciduous, 90 μ. diam., spores sub-hyaline, oblong 9 × 2 μ. On lvs. of some *Solanum*. Lexington, Ky., Aug., 1882. Professor W. A. Kellerman.

Phyllosticta toxica E. and M.—Spots gray, round, small, border dark-brown; perithecia black, epiphyllous, innate, 70 μ. diam., spores sub-hyaline, nearly globose, granular, 6–7½ μ. On fading lvs. of *Rhus Toxicodendron*. Decorah, Iowa. E. W. Holway.

Ascochyta Smilacis E. and M.—Spots pallid, round, border brown; perithecia black, globose, innate, epiphyllous, 140 μ. diam. spores sub-hyaline, ovate, triseptate, 11–22 × 6–7 μ. On lvs. of *Smilax rotundifolia*. Concord, Pa.

Glæosporium Betularum E. and M.—Spots light-brown, nearly round, 2–3mm diam., border dark; pustules brown, amphigenous, 120–140 μ., falling out and leaving a dark cup-shaped scar; con-

idia hyaline, obovate and ovate, 9–10½ × 6 μ., hyphæ hyaline. On lvs. of *Betula nigra* and *B. lenta.* Bethlehem, Pa., Sept., 1882. E. A. Rau. Differs from *G. Betulæ* Mont., and *G. betulinum* Kickx., in its *ovate* conidia.

Macrosporium Solani E. and M.—Hyphæ brown, erect, somewhat curved, caespitose, septate, 50–70 × 3–4½ μ.; conidia brown, oblong-obovate, pedicellate, endochrome divided by transverse and longitudinal septa; pedicel hyaline, septate above; conidia, including pedicel, 100–140 μ. long by 15–18 μ. wide. Growing mostly on the under surface of eroded spots and faded portions of the dying leaves of *Solanum tuberosum.* Newfield, N. J.

Macrosporium Catalpæ E. and M.—Hyphæ brown, curved, nodulose, 8–12 septatę, erect, amphigenous, 90–135 × 6 μ; conidia brown, obovate and pyriform, sub-muriform, 27–54 × 15–27 μ. On brown spots on the lvs. of *Catalpa bignonioides.* Bethlehem, Pa., Oct. 1882. E. A. Rau.

Macrosporium herculeum E. and M.—Amphigenous, on dark-gray, round spots; hyphæ erect, brown, caespitose, flexuous, sparingly septate, 70–80 × 5 μ; conidia brown, clavate, multiseptate with a few imperfect longitudinal septa, 200–225 × 21–26 μ. On lvs. of *Nasturtium Armoracia.* Newfield, N. J.

Cercospora canescens E. and M.—Spots brown, border yellowish-brown, broad and irregular; hyphæ caespitose, brown, 110 × 6 μ., conidia, hyaline, cylindric-clavate, 5–8 septate 117 × 6 μ. On fading leaves of *Phaseolus.* In gardens.

Cercospora flagellare E. and M.—Spots pallid, ½–¾ cent. diam., sometimes confluent; hyphæ tufted, brown, crooked and nodulose 75–80 × 4 μ., bearing at their tips the long, 80–112 × 4 μ., slender conidia, attenuated above, and 8–10 septate. Amphigenous, but more perfectly developed on the under side of the leaf. On lvs. of *Phytolacca decandra.*

Cercospora Echinocystis E. and M.—Hyphæ brown, fasciculate, scarcely septate, hypophyllous 42 × 4 μ on white round, indefinitely bordered spots; conidia hyaline, cylindrical, clavate, 80–105 × 3 μ., 3–6 septate. On lvs. of *Echinocystis lobata.* Lexington, Ky., Professor W. A. Kellerman.

Cercospora Dioscoreæ E. and M.—Hyphæ caespitose, brown, scarcely septate, hypophyllous, 30 × 3½ μ.; conidia sub-hyaline, cylindrical, 3–8 septate, 54–90 × 4–5 μ. The upper surface of the leaf is mottled with dark-brown spots with a yellow border, but the fungus is found on the under surface. On lvs. of *Dioscorea villosa.* Chester Co., Pa.

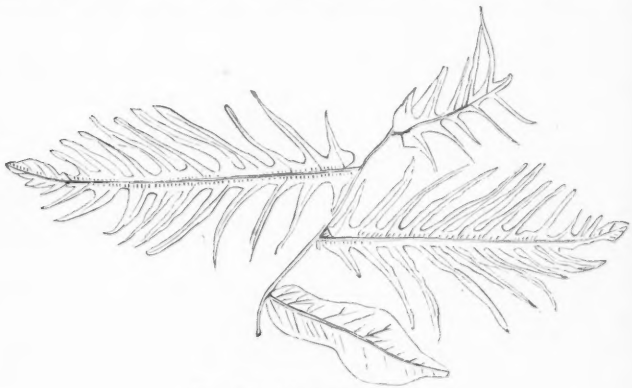
Ramularia Plantaginis E. and M.—Spots small, round, light-gray, border reddish-brown; hyphæ caespitose, hypophyllous, hyaline; conidia, cylindrical, 15–21 × 3–4½ μ. On lvs. of *Plantago major.* Kentucky, Professor W. A. Kellerman.

Ramularia Celastri E. and M.—Spots small, white, border dark-brown; hyphæ sub-hyaline, fasciculate, 24 × 3 μ.; conidia oblong-

cylindrical, hyaline, guttulate, uniseptate, 18–21 × 3 μ. On lvs. of *Celastrus scandens.* Chester Co., Pa.

Oospora Tulipiferæ E. and M.—Hyphæ subhyaline, becoming brown, septate, caespitose, 42 × 3 μ., on light-brown spots, with a dark, narrow border; conidia subhyaline, ovate or fusiform-concatenate, borne on the tips of the hyphæ, 7–9 × 3–4½ μ. On lvs. of *Liriodendron.* West Chester, Pa., Dr. Martin, and Bethlehem, Pa, E. A. Rau, Sept. and Oct. Common.—*J. B. Ellis, Newfield, N. J., and Dr. G. B. Martin.*

Cut-leaved Beech.—Miss Kate Furbish sends tracings (here reproduced one-third natural size) of some pinnately lobed leaves of the beech, taken from a tree at Chesterville, Me. Dr. Packard found similar leaves at Brunswick, Me. The latter we have ex-



Pinnately lobed Beech leaves.

amined, and find that the lobing is due to the early breaking down of the parenchyma midway between the veins, the growth of the rest of the leaf tissue continuing in the usual way. Probably Miss Furbish's specimens were produced in the same manner.

Agency of Water in Forest Destruction.—The note in reference to the discussion of this topic before the Philadelphia Academy (see p. 622, July number, Am. Nat.) is correct, so far as it goes, and yet from its brevity possibly gives a very different impression of the facts than actually occurred.

The discussion arose from a letter read from Professor Sheafer, of Pottsville, detailing a case where a large area of forest was destroyed by the construction of a beaver dam. Mr. Meehan simply gave instances of a similar character, where, by the formation of railroad embankments, immense areas of forests had been destroyed, and geological instances from now treeless prairies, in which buried forests had evidently been destroyed by water. He incidentally referred to his former addresses before the Academy,

on the washing away of the soil on the tops of high mountains, and the relation of the "timber line" to these facts, and suggested that in theories of the disappearance of forests both in the past and in the present, the agency of water as well as of climate should not be overlooked. It was not this that Professors Leidy, Heilprin, Koenig, and Redfield opposed, but in their experience they had found that so far as the question of the "timber line" was concerned, climatic influences had as much, if not more to do in deciding it, than the mere washing away of the soil by rains or melting snows.—*Thomas Meehan, Germantown, Pa.*

On the Heterœcism of the Uredineæ.—Charles B. Plowright recorded last year in the December number of *Grevillea*, the results of a series of experiments upon the barberry cluster cup (*Æcidium berberidis*) and wheat rust (*Puccinia graminis*), which led him to "differ from the eminent botanists abroad who do accept the heterœcism of *Puccinia graminis* as established beyond question." This year he made another series of experiments, the results of which he gives in the September *Grevillea* as follows: "This year another series of cultures was instituted, in which the promycelium spores [sporidia] of *Puccinia graminis* were sown upon young barberry plants, with the unvarying result of producing the Æcidium, the check plants remaining free from the fungus. Young wheat plants, which were kept continuously covered by bell glasses from the time they were first sown till the experiment was concluded, were also found, when infected with ripe *Æcidium berberidis* spores, to become infected with Uredo, while similar plants not so infected remained healthy,"

The experiments were so conclusive that Mr. Plowright, who entered upon them "biassed against" the doctrine of heterœcism, now fully accepts it.

Note on Gerardia.—It may be worth recording that *Gerardia pedicularis* L., although blooming profusely about Providence this season, yet owing, perhaps, to the long-continued drouth, is not nearly so much frequented by humble-bees as usual. Indeed, I notice more honey-bees about the plants. The consequence is, that much fewer flowers are perforated in the manner I have before described. In a half hour's careful observation I did not see one humble-bee avail himself of the holes already cut, nor make a new perforation. All entered by the open mouth of the corolla. There would seem then to be no necessary impediment to their means of ingress. Does not the diminished number of seekers account for the legitimate action of the few? Absence of active competition renders it unnecessary for the remaining bees to adopt a burglarious habit.—*W. W. Bailey, Brown University, Sept. 4, 1882.*

ZOÖLOGY.

A NEW GENUS AND SPECIES OF THE CRUSTACEAN FAMILY LYNCODAPHNIDÆ.[1]—*Lyncodaphnia*, gen. n. (Plate XVI, Fig. 1–4). Form much as in species of Alonella, etc., truncate behind; superior antennæ like Macrothrix, attached movably to the end of a blunt prominence beneath the head; second or swimming antennæ slender, four-jointed ramus with three long setæ and a stout thorn at the end of distal segment, the joint following the short basal one with a thorn above, the following joint unarmed (!); three-jointed ramus as in Macrothrix, the basal segment armed with a much elongated seta; eye relatively small, pigment fleck (*macula nigra*) present; *intestine twice convoluted*, expanded in front of the rectum, opening in the "heel" of the post-abdomen; post-abdomen slender, sub-triangular, margined behind with a double series of spines; terminal claws large, and furnished with a long and short spine near the base; shell margined below by stout movable spines.

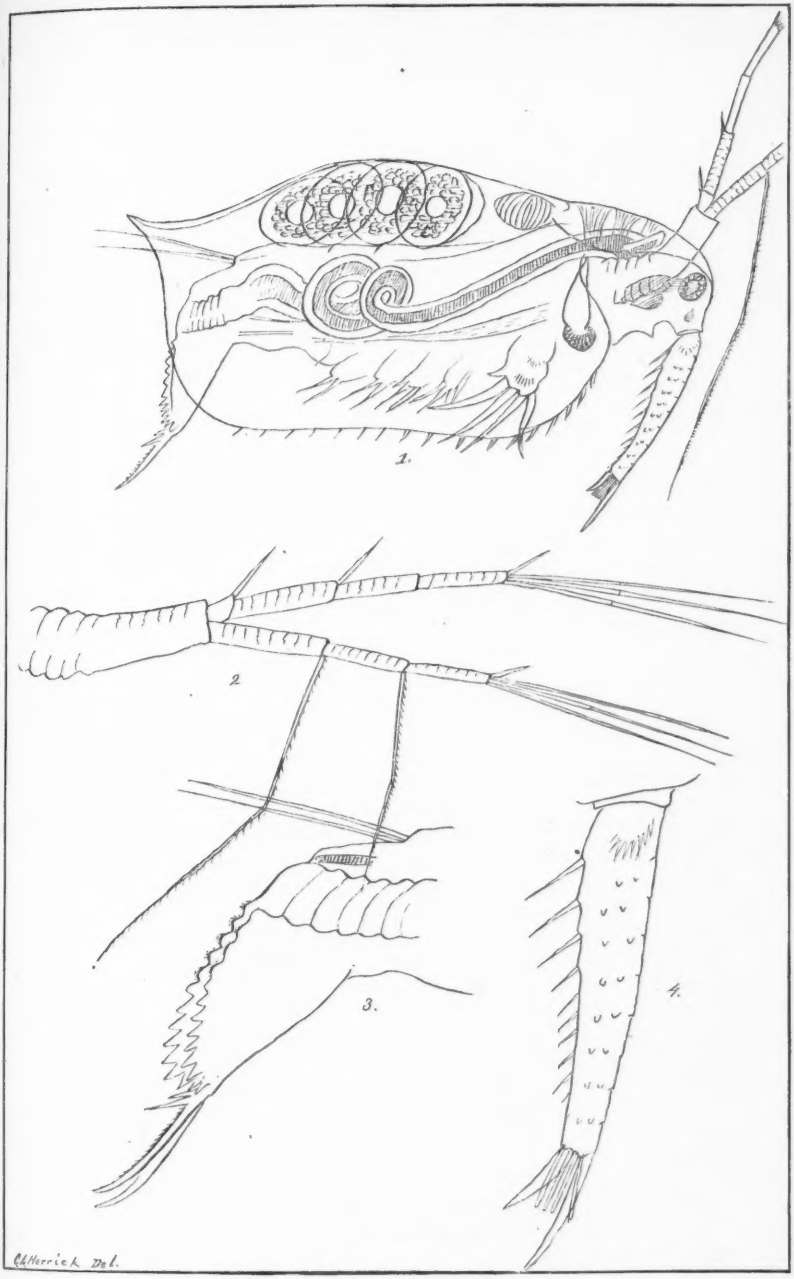
Few more interesting forms than the one forming the type of this very peculiar genus have been found, since it combines in a curious manner those characteristics hitherto regarded as distinctive of the families Daphnidæ and Lynceidæ. Kurz says:[2] "Keine cladocerenfamilie bildet eine so streng in sich abgegrenztes natürliches Ganze, wie eben die Lynceiden," and this after recognizing the relationship of Macrothrix and Lathonura to the Lynceids, by placing them in the sub-family Lyncodaphnidæ. The form above referred to, however, has quite as close affinity to the Lynceidæ as to Macrothrix, though it resembles the latter rather more on a superficial examination, indeed if one were to divide the animal back of the heart and examine the two portions independently, it would be impossible to avoid referring the head to Macrothrix and the body to some Lynceid genus. Thus is furnished another of those curious intermediate forms which remind us that the possibility of distinguishing families and genera, lies alone in the meagerness of our knowledge.

There can be no doubt that this genus should stand next to Macrothrix, but it will be necessary to modify a little the diagnosis of the Lyncodaphnidæ to receive it, and it then appears that it cannot longer remain a sub-family of the Daphnidæ, hence I have proposed to give it equal rank with that body and the Lynceids as an independent family, Lyncodaphnidæ, including the genera Macrothrix, Lyncodaphnia, Drepanothrix, Lathonura (= Pasithea), Ilyocryptus. As thus limited a very natural group is formed, in size and isolation corresponding well with the other related families.

[1] Series secunda generum (Daphnidæ), sub-fam. Lyncodaphninæ Kurz. Danmark's Cladoceras, p. 134. Dodekas neuer Cladoceren, P. E. Müller, p. 24.

[2] Kurz. Dodekas neuer Cladoceren nebst einem kurzen Ubersicht, der Cladoceren fauna Bönmens, p. 30.

PLATE XVI.



Lyncodaphnia macrothroides.

JAN 10 1912

Lyncodaphnia macrothroides, sp. n. — Form sub-rectangular, greatly elongated; length $\frac{12\text{ cm}}{100}$; height $\frac{5\text{ cm}}{100}$ or less; first antennæ long and slightly curved, bordered behind by about ten spines, and terminating in two or three sword-shaped unequal spines and several sense-hairs, about $\frac{17\text{ cm}}{1000}$ long; swimming antennæ very slender, as in Macrothrix, $\frac{6\text{ cm}}{100}$ long; head not marked off by a depression from the body, small and extending below into a blunt elevation for attachment of antennæ; labrum rather large; eye small; macula nigra conspicuous but not large; anterior feet strongly armed with curved spines; intestine anteriorly is furnished with cœca, is twice convoluted, broadened before entering the rectum, and opens some distance beyond the anal setæ in the heel of the post-abdomen; post-abdomen rather slender, toothed behind with a double series of about twelve prominences, ciliated near the anus but distally becoming strong, sharp teeth; terminal claws large, curved only at the end, pectinate and bearing near the base a small and large tooth; eggs much like those of Macrothrix. Male not seen.

Occurs in Lake Minnetonka, Hennepin county, Minnesota; rare.—*C. L. Herrick.*

Food of the Nestlings of Turdus migratorius.—In this vicinity robins usually rear two broods in a season—sometimes three—and occasionally young birds that are hatched in May will mate and repair the nest in which they were born, or build a new one, and rear a brood in August and early September, thus becoming parents at the age of about four months. The nestlings of the earlier broods are mostly, if not exclusively, fed upon animal food—insects in all stages of development—while the later broods receive a large share of fruit when in the nest, and after leaving it, so long as they require the attention of their parents. Near the farm-house, or in the village, the old birds take strawberries, currants, gooseberries, cherries, and the cultivated small fruits generally for their young as well as for themselves, and in the fields and woods they use almost indiscriminately strawberries, blackberries, huckleberries, blueberries, and wild cherries for their nestlings, without giving up the use of insects. The latest broods frequently get a taste of early grapes, nor is it uncommon for the parents to carry to their little ones mouthfuls of mellow apples and pears. There are but few small fruits, cultivated or wild, that are not, to some extent, appropriated as food for the nestlings when the parents can get them, and I think from observations of several years that at least one-third, probably one-half, of the food of nestling robins consists of the various fruits in their respective seasons. In the later broods, insects predominate as food during the first half of their nest-life, the fruits being principally used during the remainder and until the young are able to take care of themselves.

The statement often seen in the books that "robins feed their young entirely upon animal food," is altogether too sweeping. Without doubting the veracity of the person who first made use of this expression, I think his observations must have been confined to the earlier broods, and in the season before any fruits were ripe or approximately ripened. That robins can be reared upon animal food alone is probably true; that they are not so reared when fruits are obtainable is equally true, and in a dearth of insects they can be raised upon food consisting largely of fruit.

I am fully aware of the fact that in areas of some extent—usually quite limited however—the small-fruit grower sometimes finds the robins very annoying, and even injurious, but to the community at large, and certainly to the agriculturist and market gardener, they are decidedly beneficial and of incalculable worth, from their enormous destruction of noxious insects, especially in spring and early summer. Protected as they are by law a part of the season, I sincerely wish that the "close" time were measured by the year.—*Elisha Slade, Somerset, Mass.*

More Complaint about Passer domesticus.—This proliferous gourmand is adding a new item to his bill of fare with us this season. As soon as wheat was fully headed out, dozens of these pests could be seen in one flock to settle down in the fields on the wheat-stalks and commence picking out the grains. Now that wheat is cut and shocked, they light on these and take their fill. I have noticed similar reports in some of the agricultural papers. —*J. Schneck, Mt. Carmel, Ill.*

A Prolific Garter Snake.—July 26th, 1882, a specimen, thirty-four inches long, of *Eutænia sirtalis* B. and G., was brought to me from which were taken *seventy-eight* young; these varying from seven to five inches in length. The young were pressed from the vent. The first twenty or so were free from any covering. The remainder were in sacks, from three to five snakes in each.

May not this latter fact lead us to think this species possibly also ovo-viviparous as well as viviparous? I do not know that the number of young is without a precedent, but it exceeds, by far, anything I have observed.—*J. Schneck.*

The Spotted Spreading Adder Viviparous.—Since sending the note on the *Garter Snake*, I have learned of a still more remarkable case. A "spotted spreading adder" was shot in two, near the middle; when *eighty-seven* young were taken from her body. The snake was a large one of this species. The young were near six inches long. This occurred within the last two weeks, and in the presence of nearly a dozen persons, from several of whom I have gathered the facts.—*J. Schneck.*

HABITS OF THE ENGLISH SPARROW.—The following interesting note has been received from Dr. A. K. Fisher, of Sing Sing, N. Y.: Knowing your great *fondness* for *Passer domesticus* I send you a brief account of one of the various ways in which he imposes upon his superiors. The following was related to me by a friend, who was an eye-witness. You well know that when robins are feeding their young they will often collect a number of worms, forming a large billful, before making a trip to the nest. Well, the sparrow noticed this, too, and when the robin would alight to pick up something more, he would dash down beside the robin and snatch whatever might be in his mouth, then fly a few feet off. The robin would hop after him, when he would make another short flight until the robin would give up and go and hunt for something more. My friend saw the sparrow do this five or six times one afternoon.—*Elliott Coues, Washington, D. C.*

THE BLACK-FOOTED FERRET (*Putorius nigripes*) IN TEXAS.—Mr. Frank J. Thompson, of the Cincinnati Zoölogical Gardens, informs me of the reception there of a living specimen of this rare species, perhaps the first one ever placed on public exhibition. It was captured near Abilene, in Taylor county, Texas, a locality far beyond the previously known range of the species, as assigned in my "Fur Bearing Animals."—*Elliott Coues, Washington, D. C.*

THE OCCURRENCE OF DEMODEX PHYLLOIDES CSOKOR, IN AMERICAN SWINE.—The meat inspector for thecity of Toronto, Mr. R. Awde, has just handed me for examination, a piece of pork skin, marked by numerous white spots shining through the epidermis, which on separation of the subcutaneous tissue, turn out to be sebaceous glands, enlarged to the size of a grain of barley, and crowded with multitudes of mites (Demodex) in various stages of development. The mites belong to the species described by Dr. Johann Csokor (Verhandl der K. K. zool-bot. Gesell in Wien. Vol. XXIX, 1879, p. 419, et seg. and Pl. VIII), as occasioning large cutaneous pustules and even ulcers in a herd of swine from Galicia; so far as I am aware it has not been recorded since.

Demodex phylloides measures only 0.24^{mm} in length, while *D. foliculorum* (the little mite which occurs in the sebaceous glands near the nose in man) is often twice as long. This difference in length is solely due to the excessive shortness of the abdomen in *D. phylloides*, for the cephalothorax in the latter form is undoubtedly more robust than in any other of the described species.

D. canis occasions a very troublesome cutaneous affection in dogs. *D. ovina* occurs in the meibomian glands in sheep (vide Zürn, Schmarotzer der Haussaügethieren), and Mr. W. Faxon has recorded *D. folliculorum* from the ox, but from an economic point of view. *D. phylloides* may possibly become more disastrous than any of these should its attacks attain the extent described by

Csokor, which of course would destroy or materially depreciate the market value of the animals affected. Csokor calls attention to the fact that all of the herd in question were affected, as indicating a much readier infection by contact, than has been observed in the case of the dog. It is further to be noted that the mites in each gland are not to be reckoned by individuals or tens, as in other animals, but by thousands.

Mr. Awde finds about one pig in twenty affected, from now to the end of the pork season. The parts involved (as also in Csokor's cases) being the head, belly, and legs.—*R. Ramsey Wright, University College, Toronto.*

How Bad Weather Affects the Birds.—The early part of this season was very cold and wet, seriously impeding every operation on the farm. The temperature finally became more genial during the month of June, though the rains have kept coming at frequent intervals. Grasses, wheat, oats, and potatoes have been growing very satisfactorily, but corn, our great staple, has been sadly impeded, and its promise to-day may be set down as simply "doubtful." Coupled with all this ill luck, we have had a frequent repetition of high winds—tornadoes, in many localities, as the reader will remember. At my place we had a terrible gale the night before the destructive tornado at Grinnel; trees were blown down, fences destroyed, and the crops damaged in all directions.

This state of things has had a very disastrous effect upon the birds. They have not been as plenty as during previous seasons. I noticed this especially in regard to the house wrens, blue birds, redwing blackbirds, crow blackbirds, blue jays, Baltimore orioles, and indigo birds, possbily other species might be included. It has seemed to me that they have been kept away by this untoward weather. Then again, after the terrible storms, we have found many young birds dead, while the winds and beating rains have destroyed many nests. My attention has been directed to this subject all the season through, and I cannot but regard it as having been thus far, a most unfavorable year for all kinds of small birds.—*Charles Aldrich, Webster City, Iowa. July 3, 1882.*

Protective change of Color in a Spider.—I suppose you know the little flower spiders, that conceal themselves in the flowers, aud seize any unwary insect that may chance to come within their reach. I have generally found them white and yellow. I suspected they changed their color, and by experiment, I, find that this is so. If I take a white one and put it on a sunflower, it will get quite yellow in from two to three days. I believe they capture almost anything, but they seem to be partial to the bees. I found one the other day with a wasp, the latter was not yet dead, but it was tightly held by the throat by the spider. The next day the wasp was found lying dead under the flower.—*James Angus.*

THE STRUCTURE AND DEVELOPMENT OF THE SKULL IN STURGEONS.—Professor W. K. Parker has been working out the development of the skull in *Acipenser ruthenus* and *A. sturio*, the Russian sterlet and the common sturgeon of the shores of Great Britain. The larvæ of the sterlet that were dissected varied from one-third to seven-twelfths of an inch in length, yet even in the smallest of these the cartilage was becoming consolidated. In the skull of the sturgeon the *symplectic*, which supports the mandibular and hyoid arches, is a separate cartilage, as in the Selachians, not a mere osseous center as in *Lepidosteus* and the Actinopteri; the peculiar modifications of the primary arches of the face show themselves during chondrification, thus the hyoid arch is from the first, inordinately large, yet in the larva the head of the great subdivided hyoid pier only articulates with the auditory capsule.

There is no room for doubt that all the branchial arches are developed in the outer walls of the large respiratory pharynx, quite independently of the base of the skull and the fore part of the spinal column. Professor Parker declares that he has come to the conclusion that no true branchial or visceral arches exist in front of the mouth; the first cleft is that between mandible and hyoid, and the first arch, the mandibular. The true axis of the cranial skeleton ends under the fold of the mid-brain, and the "trabeculæ cranii" are merely fore-growths from the parachordals. In the sturgeons the ganoid scutes of the head are so far under the influence of the huge chondrocranium, to which they are applied, that they may be called frontal, parietal, etc., yet such scutes are not the exact homologues of the bones so named in the Actinopteri. The sturgeons, on the whole, stand between the Selachians and the bony ganoids, yet not directly in the line between the Selachians and the bony ganoids, and not directly in the line between any one family of the former and any one family of the latter. Larval sturgeons are miniature sharks in appearance, since for weeks they have a shark-like mouth, true teeth in the throat and on the lips, and very long exposed gills.

THE AMYLOLYTIC AND PROTEOLYTIC ACTIVITY OF PANCREATIC EXTRACTS.[1]—Dr. W. Roberts gives the result of his researches upon the Amylolytic (sugar-forming), and Proteolytic action of the pancreatic juices. Following Kuhne, he proposes to distinguish soluble ferments, devoid of powers of growth and multiplication, from organized ferments, such as yeast, by giving them the name of *enzymes*. The pancreas is the source of two enzymes, *pancreatic diastase*, and *trypsin*, which latter has the proteolytic power of converting casein into *metacasein*, which curdles by simple boiling. The pancreatic juice of the pig has great diastatic power, since it is capable of transforming four times its weight of dry starch at 40° C., to the point at which it no longer

[1]Proc. Royal Society. May 5th, 1881.

gives a color reaction with iodine, in five minutes. If the diastatic power of the pig's pancreatic juice be represented by 100, those of the ox and sheep, feeders on matters poor in starch, are respectively only eleven and twelve. Cold retards the action of the pancreatic juice; a temperature of from 30° to 45° C., is most favorable to diastetic, while one of 60° C. is most favorable to proteolytic or tryptic action; and these actions cease to take place at 70° C., and 80° C., respectively. Double the quantity of an enzyme will do its work in half the time, while half the quantity will require double the time, but this rule of inverse proportion is controlled by the rule that an enzyme liberates its energy at a progressively retarded rate.

THE BIRDS OF HELIGOLAND.—The Bull. Soc. Zoöl. de France (1882) contains an interesting account of the birds of Heligoland, by M. E. de Selys Longchamps. Herr Gatke, secretary of the local government, is the resident ornithologist, and has collected 400 species out of the 500 known in Europe, including many examples of some of the rarest species. In his own words, "Birds from very different regions, from the north and south of Europe, and all the north of Asia and America, choose this solitary rock as a place of repose during their migrations." The island, a more or less clayey and ferruginous rock of lower iriassic age, of so little consistency that, at the rate it is wearing away, it will disappear in four or five hundred years, lies in the direct course of the birds which migrate every year from Southern Europe and Africa to the Arctic regions. As many as 15,000 larks were captured on the evening of Nov. 6, 1863. M. Gatke has proved, by the concordant dates of the captures of erratic birds, that these accidental migrations are regular up to a certain point, since for the same species they take place at the same time of the year, and in general consist of several species coming from the same geographical regions. Among the birds taken are *Phyllopseuste borealis* (Arctic Asia, N. E. America); *Phyl. nitidus* (Himalayas); *Phyl. coronatus* (Malaysia); *Calamodyta agricola* (India — not before observed in Europe); *Cal. certhiola* (coast of Sea of Ochotsk); *Pluvialis virginicus* (Alaska); *Totanus rufescens* (America), and *Larus roseus*, a circumpolar bird, lacking in most collections.

ZOOLOGICAL NOTES.—The *Quarterly Journal of Microscopical Science* for October, contains a brief account, by Dr. R. Horst, with excellent figures, of the development of the European oyster. He claims, contrary to Lacaze Duthiers and W. K. Brooks, that the bivalve shell of Ostræa is originally unpaired, not developed from two separate halves, which afterwards unite and form a hinge.——The thread cells and epidermis, with the lateral glands of Myxine, the hag-fish have been studied by J. E. Blomfield.——The eye of Spondylus has been found by S. J. Hickson, to be

similar to, though less developed, than the eye of Pecten.——In the same journal, P. H. Carpenter continues his notes on Echinoderm morphology.——E. R. Lankester claims that he has discovered in the tail of Appendiculariæ, that the muscles are arranged in a series of segments (myomeres), seven in number, one corresponding to each pair of nerves given off by the axial nerve cord. ——H. N. Moseley, from a study of the soft parts, finds that the corals Seriatophora and Pocillopora are genuine corals like Madrepores, as regarding the latter genus confirming Verrill's opinion as to their affinities.——The Cilio-flagellate Infusoria have been studied by Bergh, who proves that the external membrane or skeleton consists of cellulose, this being the first time that cellulose has been demonstrated in the cell-wall of the Protozoa. The protoplasm of these organisms says Prof. Parker, in his review of Bergh's work, is usually divided into ectoplasm and entoplasm. The latter has been found by Bergh to contain chlorophyll, diatomin (the yellowish-brown coloring matter of diatoms), and starch. Chlorophyll is already known to occur in many animals of widely separated groups; starch has hitherto been proved to exist only in the green Turbellarians, and diatomin has never before been known out of the vegetable kingdom. Bergh believes that in many genera of these infusoria, the nutrition is entirely like that of a plant, and that no solid nutriment is ever taken up. Bergh figures the lasso-cells or trichocysts of Polycricus, as originally discovered by Bütschli.——Mr. A. Agassiz, continues in the Proceedings of the American Academy of Arts and Sciences, his account of the young stages of osseous fishes. Many interesting points of relationship between the embryos of bony fishes and their fossil forms, have been traced by comparing the structure of the tail of the fish embryo, as it passes from the leptocardial stage through the various stages of heterocercality, to a so-called homocercal stage. This relation, says Agassiz, is very marked, and has led to some important generalizations. He finds, however, that the comparisons of the pectorals, or of the dorsal and anal fins does not lead to such interesting results, though as far as the pectoral fins are concerned, their resemblance in the early stages of the bony fish embryo to the Crossopterygian type of pectorals is very striking. Excellent figures are given of the very young striped bass, blue fish, butter fish, toad fish, goose fish, sculpin, lump fish, stickleback, cod, smelt, and a few others.——Besides an elaborate and beautifully illustrated article, with anatomical details on the larvæ of mayflies, by A. Vayssiére, recent numbers of the *Annales des Sciences Naturelles* contain a continuation of A. Milne-Edwards mémoir on the avi fauna of the Antarctic regions. The stomachal armature of the crab, *Birgus latro*, is described by M. Mocquard. The more notable articles in the number issued in August, are Rietsch's study of *Sternaspis scutata*; Fuch's paper on the fauna of deep seas, and Giglioli's essay on the deep-sea

fauna of the Mediterranean; there are besides, several ornithological papers by Oustalet and others.——*Zeitschrift für Wissenschaftliche Zoologie*, August 1, contains an elaborate memoir by H. Ludwig, on the embryology of a star fish, *Asteria gibbosa*. There is throughout the Echinodermata a mode of development, which must be spoken of as a metamorphosis, all the larvæ being ciliated, with a mouth and anus on one side. The processes by which the primary larva is converted into the echinoderm appear to be essentially the same in all cases; all that happens in a more complicated history, being the fact that in the secondary larvæ there is an absorption of those larval parts which had themselves become secondary. The secondary characters are not to be regarded as having anything to do with the future organization of the echinoderm, but as adaptations proper to the larval life, and disappearing at its close. There is no true solid morula in the earliest phases of development, but a blastosphere with a unilaminate wall; the gastrula is formed by invagination. Especial attention is given to the mode of origin of the hydrocœl, the blood vascular system and stomodæum, as well as the skeleton.

ENTOMOLOGY.[1]

A NEW RICE STALK-BORER: GENUS-GRINDING.—We quote the following from an article on a new Lepidopterous insect which, in the larva state, bores the stalks of rice. The article occurs in the annual report of the U. S. Entomologist for 1881-2, already printed:

"We have had some difficulty in deciding as to the true specific determination of this insect, chiefly because of a close general resemblance which it must possess to other species. Mr. Grote, when we showed him a specimen last autumn in New York, thought it might possibly be his *Chilo crambidoides*, while Professor Fernald determined it, from a specimen which we sent him, as *Diphryx prolatella* Grote,[2] stating at the time that he might be wrong, but that, having seen Mr. Grote's type, he considered our insect identical with it so far as he could trust his recollection. The specific description of *D. prolatella* certainly does agree very closely with the species we are considering, which has also the mucronate clypeus of Diphryx, but in order to refer our insect to *D. prolatella* we must assume that Mr. Grote erected his new genus, *Diphryx*, on a mutilated specimen which had lost its maxillary and part of its labial palpi, for the genus is founded on short labial papi which hardly exceed the face, and the absence of maxillary palpi—characters decidedly exceptional and remarkable in the family. In order to settle the matter, therefore, we again referred, through Mr. Henry Edwards, a perfect specimen

[1] This department is edited by Professor C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

[2] N. Am. Moths, Bull. U. S. Geol. Survey; VI, No. 2, p. 273.

to Mr. Grote, who upon this second more careful examination decides that it is neither of the species mentioned, but an undescribed species of Chilo."

Accepting Mr. Grote's decision, we described the insect as *Chilo oryzæellus*, but ventured the following opinion: "As Mr. Grote's types are in London he may be mistaken even in his final opinion, and the careless manner in which he has often made other genera renders it quite possible that Diphryx is a myth, founded on an imperfect specimen as above indicated."

In order to get positive information on the point in doubt, we subsequently mailed specimens of our *C. oryzæellus* to Lord Walsingham, with the request that he compare them with the type of *Diphryx prolatella*. His Lordship promptly replies by date of October 1, 1882: "I had no difficulty in finding this and ascertaining that you are completely justified in your conclusion that the Crambid No. 2557 [*C. oryzæellus*] is the same species. Grote's type is a female, and has the palpi (labial) broken off, the shorter maxillary palpi alone remaining."

It is apparent, therefore, that Mr. Grote not only founded the genus Diphryx on what has no existence in nature, but mistook, besides, the maxillary for labial palpi.

Effect of Pyrethrum upon the Heart-beat of Plusia brassicæ.—While engaged in experimenting for Professor Riley, with different samples of Pyrethrum, upon various lepidopterous larvæ, in September of the present year, I was much interested in noting the enormous increase in the rapidity of the pulse which the poisoning occasioned with the larvæ of the cabbage Plusia. These larvæ are so very delicate and transparent that the course of the vital fluid can be observed with ease, and repeated countings show the normal heart-beat to range between 44 and 68 per minute, averaging about 56. In the first convulsions from the effects of Pyrethrum the pulse immediately rose, and in the course of ten minutes reached from 150 to 164, and usually subsided in the next fifteen minutes to the neighborhood of 140. As the convulsions ceased the pulse fell but slightly, but became very weak, until, finally, it could be counted no longer. The last count before the heart ceased to beat, apparently through the paralyzing of its walls, showed a rate invariably of about 130 to the minute.—*L. O. Howard.*

A Butterfly Larva injurious to Pine Trees.—In the course of some remarks recently made by Dr. H. A. Hagen before the Entomological Society of Ontario, at its meeting in Montreal, he gave an interesting statement of the injury of *Pieris menapia* to pine forests in Washington Territory, and particularly in Colville valley, twelve miles from Spokan.

The caterpillar, found in all stages, destroys mostly the yellow

pine, but in some rare cases tamarack. The eggs are of the usual Pieris form and are laid in a series of a dozen or two in a straight line on the leaves. The caterpillar eats all the leaves except the fasicle at the end. Then all the tips turn upward and give to the tree a chandelier-like appearance. The larva comes down rom the tree on a thread, some fifty feet or more. In the middle of July near Spokan, a number of old males were found; higher up in the valley they grew more numerous, in some places many thousands being observed on one tree, presenting the appearance of snow flakes in the distance. The larva was found in all stages and the chrysalides were abundant.

On July 24th females and fresh males abounded. They paired at once and laid eggs the same day. The destruction seems to have been great but localized, and Mr. S. Henshaw and Mr. H. R. Stretch assisted Dr. Hagen in his observations.

The species has long been known to differ from the rest of its genus in its pine-feeding habits, and to be uncommonly numerous, at times, in various parts of the Rocky mountain region; but we have never heard of such disastrous consequences as those reported by Dr. Hagen.

ENTOMOLOGY IN WASHINGTON TERRITORY.—In following Dr. Hagen's remarks on the insects observed during the past summer in Washington Territory, Mr. S. Henshaw mentioned, at the late meeting of the Entomological Society of Ontario, some points of interest observed during the trip. Among the Hymenoptera, bees and wasps were very abundant, the forms of Odyneri being especially so; very few Multillidæ were found; the agricultural ant was observed in Montana.

Lepidoptera Rhopalocera were extremely abundant in specimens, but comparatively few species were observed.

Papilio machaon form *oregonia* occurred abundantly at Umatilla, Or., June 24th, and was also taken at several points in W. T., along the Yakima and Columbia rivers. Among the Heterocera, very few Sphingidæ occurred, five species of Ægeridæ were taken, and the most interesting Bombycid is a "basket-worm" (Thyridopteryx sp.?), found in Colville valley, W. T., and also in Montana. Cossus was very abundant on cotton-wood, and a number of interesting Notodontoid larvæ were taken. Night work yielded very poor results.

With the Diptera, Tabanidæ, Asilidæ, Bombyliidæ and Syrphidæ were most numerously represented. The occurrence of *Eristalis tenax* at Portland, Or. (common in Europe, and recorded in this country, first in 1875, from N. E. Geo. and Ill.), is of interest.

Two species of Omus (Dejeani and Audouini?) were common at Portland, Or., and the last named occurred at one locality east of the Cascade mountains in W. T. The distribution of Audouini (?) was confined to the mountain cañons, while Dejeani was equally common in such situations and along the river banks.

A number of Clivinæ and other Carabidæ usually found in moist situations, were taken in the driest parts of sand plains.

The most important discovery among the Orthoptera, is the capture of two specimens of Myrmecophila at Portland, Or. So far as known, there is but a single authentic record of the occurrence of the genus in this country.

A few species of Perlids were very abundant; a large series of two rare Gomphids were taken, and the occurrence of the genus Calopteryx on the banks of the Yakima, is of importance, as it is the first record of the genus west of the Rocky mountains, which were supposed to be a barrier to their western progress. As species occur far north, it is suggested that the passage is through the mountain passes beyond the limits of the United States.

A point of interest, and noticeable throughout W. T., is the late hour at which insects are on the wing. It was a matter of common occurrence to see Odonata belonging to the genera Aeschna, Libellula, Diplax, &c., hawking about from after sundown till dark. In New England and Europe, with the exception of a few species of Aeschna and Cordulia, none are seen on the wing later than the early afternoon.

THE ARMY-WORM IN 1882.—The damage to crops from the Army-worm in the more northern States, which we predicted in the June number of the NATURALIST, while not nearly so great as in 1880, has still been marked in certain localities, notably in Saratoga county, N. Y. The year 1882 will, however, be noted as a disastrous Army-worm year in many of the Southern States. Never before in the history of its appearances has the worm been so general south of Mason and Dixon's line. The first week in May it appeared in force in the northern counties of Alabama, and shortly afterwards in nearly all the southern counties of Tennessee. Later, alarming reports were received from Kentucky, North Carolina, Virginia and Maryland, and in June some fields of grain in the District of Columbia were badly damaged. The first week in August a correspondent in Avoyelles parish, La., sent us genuine northern Army-worms, with the report that they were greatly injuring the corn crop, but were not so numerous as they had been in May and June. Moreover, Dr. Chas. Mohr informs us that the hay crop around Mobile, Ala., was completely ruined by an army-worm which, from all accounts, seems to be the true *Leucania unipuncta*.

THE WHEAT-STALK WORM ON THE PACIFIC COAST.—Mr. J. A. Starner, of Dayton, Columbia county, Washington Territory, has recently sent us wheat-stalks containing larvæ which he states have caused a shortness of the crop for several years. An examination of the stalks showed many larvæ and pupæ seemingly identical with those of *Isosoma tritici* Riley, described in the March number of the NATURALIST, and working in a precisely

similar manner. From the great difference in locality, the presumption would be that the species would prove distinct, for *tritici* has never been found farther west than Washington county, Missouri. The rudimentary wing-pads of the pupæ, however, showed the western species to be wingless like *tritici*, and the imago, when it was subsequently bred, proved specifically identical.

We remember seeing, in 1879, a correspondence in the columns of the *Pacific Rural Press*, relative to a wheat-stalk worm which was doing some damage to the crop in California. Specimens were referred to Dr. Packard, who pronounced them in all respects similar to *Isosoma hordei*, the well-known joint-worm fly, except that they lacked wings, It seems quite probable that this insect was also *I. tritici*.

DESERVED HONOR.—We are glad to learn from a note in the June number of the (London) *Entomologist* that Miss Eleanor Ormerod has been appointed consulting entomologist to the Royal Agricultural Society, of Great Britain. We have had, on several occasions, the pleasure of referring to the excellency of Miss Ormerod's writings in economic entomology, which is beginning to be appreciated even in Great Britain.

IMPORTANT WORK ON CYNIPIDÆ.—Dr. Gustav Mayr has followed up his excellent paper on "Die Genera der gallenbewohnenden Cynipiden," by another, just published, entitled, "Die Europäischen Arten der gallenbewohnenden Cynipiden." In this latter paper 142 species of 22 genera are described by means of the synoptical tables which Dr. Mayr has adopted and uses altogether for this kind of work. From its completeness, and from its very practical form, this paper cannot but give an added impulse to the study of the Cynipidæ, both in Europe and in this country.

REMARKABLE FELTING CAUSED BY A BEETLE.—A few weeks ago we received from Mr. Henry Hales, of Ridgewood, N. J., a piece of pillow ticking, the inside of which was felted with a fur-like coating made from particles of the feathers with which the pillow had been filled. The felting is remarkably dense, evenly coating the whole surface of the piece of ticking, and greatly resembling in softness, smoothness and color the fur of a mole. We give Mr. Hales's own words:

"Enclosed I send you a piece of pillow-case which was filled with chicken feathers of various colors, in a neighbor's house. The pillow was noticed to gradually shrink, and when opened to ascertain the cause, it was found that a little beetle had bred and multiplied in the pillow, stripped all the soft parts of the feathers off the stems and felted the pillow-case inside with the feathers, making it one uniform color. The whole fabric, over a yard square, was all evenly covered as the enclosed piece which was cut from it. Do you know the insect? Is it an unusual occurrence?"

The insect is the common Dermestid beetle, *Attagenus megatoma.* An examination shows that the short, downy particles of feathers are all inserted by their basal ends, and the explanation of the felting is of course simple enough, when the barbed nature of these fine feathers is remembered, the barbs all directed towards the apex. In the regular shaking of the pillow, each of the minute particles of feather whenever caught in the cotton fabric by its base, became anchored in such way that every additional movement would anchor it firmer. The remarkable thing about the present case is that the felting should be so beautifully regular. We do not remember to have seen any published account of a similar felting resulting from the work of a beetle.—*C. V. Riley, in Rural New Yorker.*

LOCATION OF TASTE IN INSECTS.—J. Kunckel and J. Gazagnaire find that gustation in the Diptera begins with the paraglossæ, at the point at which the false tracheæ open, and is continued along the false tracheæ, becoming intensified at the extremity of the epipharynx, where quite a group of nerve-endings occurs; it is prolonged along the margins of the epipharynx and operates at the entrance or throughout the cavity of the pharynx.—*Journal of the Royal Microscopical Society.*

VITALITY OF INSECTS IN GASES.—From the apparent indifference of some insects to foul and poisonous emanations as well as the varying sensitiveness of others under similar conditions, it would seem reasonable to conclude that there is a substantial difference in the delicacy of their respiratory functions, which might be indicated approximately by subjecting individuals of various groups to artificial atmospheres of deleterious or irrespirable gases.

This opens a wide field of experimentation both in the methods employed, the reagents used, and the insects examined. More from curiosity than any other motive, I have made some trials in this direction, and the results may at least be tabulated, though they have not been extended enough to admit of any very interesting deductions.

The vessels used in these experiments were large glass bottles, the mouths of which were fitted very tightly with rubber corks, these latter were perforated by two circular holes in which were secured a long and short glass tube made air-tight in their fittings by the pressure applied to the rubber cork upon insertion. These glass tubes were one-half inch in diameter, and served as an inlet and outlet for the gases, upon charging the bottles, and were in turn closed by small rubber corks.

The gases used were oxygen, hydrogen, carbonic oxide, carbonic acid anhydride, prussic acid vapors, nitrous acid fumes, chlorine, laughing gas (nitrous oxide) illuminating gas and ammonia. The experiments were made at the commencement of

the fall of 1881, and but a few species of insects, and those the most common were obtained for trial, and from want of time the experiments were necessarily incomplete.

Oxygen.—The insects introduced in this gas at first showed slight symptoms of exhilaration and excitement, moving rapidly, flying, accompanied with a restless inclination to jump; this passed away and the prisoners seemed totally unaffected by the excess of oxygen about them and when finally they succumbed, it seemed in some cases as much due to confinement as to the super-excitatory qualities of the gas they were breathing. Their resistance to the hurtful effects of the oxygen varied extremely, both in individuals of the same species and of different species, but in all cases the gas impaired their vitality only after long exposure to its influence.

Flies (*Musca domestica*) lived in the jars, completely charged with oxygen, from nine through fourteen, fifteen, twenty-three, to twenty-nine hours.

Colorado beetles (*Doryphora decemlineata*) were confined in oxygen for three days, and at the end of that time showed only a slight torpidity, which entirely disappeared when they were liberated, and they resumed their destructive habits apparently uninjured.

The larvæ of the Colorado beetle died in the oxygen after displaying great discomfort under its action after one and one-half day's exposure.

Meal bugs (*Upis pennsylvanicus*) were introduced into the oxygen with the Colorado beetles, and behaved in a similar manner though noticeably rendered more torpid and inert. They recovered completely upon their release. The common yellow butterfly (*Colias philodoce*) fluttered convulsively in the gas, but yielded to any injurious influence exerted by the gas over it, very slowly, dying in twelve hours, possibly as much from the effects of its own violence and consequent exhaustion, as from the power of the gas.

Moth (*Noctua*—) unexpectedly exhibited great vitality, living over one and one-half days.

Harvest men (*Phalangium dorsatum*) evinced considerable excitement in the oxygen, and lived twenty-four hours.

Hydrogen.—Flies (*Musca domestica*) were instantly knocked down and after a few struggles became quiescent, with complete paralysis and plication of legs, in fifteen to twenty minutes, or in some cases in five minutes. Though this prostration closely resembled death, and was so in many instances, yet some of the flies were actuaily alive for a long time afterwards. After twenty-four hours confinement one fly revived sufficiently to fly, though its legs remained crumpled beneath it.

Colorado beetles evinced a wonderful vitality in this suffocating atmosphere; the relation of two experiments will illustrate this.

In the first case a good-sized vigorous individual was dropped into the bottle, the vessel fully charged and the openings shut. The hostile atmosphere quickly affected the insect; after a few exertions to break its way out, it fell over, opening the elytræ and protruding its wing membranes, and although occasionally moving, it remained for a long time motionless. In an hour these movements were more noticeable. The beetle remained here for ten hours longer at the end of which time it was kicking, and after the least possible admission of air which failed to elicit any signs of relief from its fellow prisoners, commenced to walk. It was taken out in twenty-four hours, and revived so thoroughly as to appear actually unharmed.

In a second case several individuals apparently succumbed at once, but in twelve hours recovered partially and crawled around, and after remaining in the gas almost two days, were removed, and were active and lively. These were then introduced into an atmosphere of carbonic acid anhydride, in which they remained four hours, and then eventually recovered, when refreshed by air and food.

The snapper (*Elater communis*) displayed very inferior power of resistance to the noxious effects of the gas, reviving in one case, but feebly in twenty-four hours, and in another found dead in thirty hours.

Moths (*Noctua*--) died in twenty minutes, though instantly upon introduction, were thrown on their backs and paralyzed.

A black wasp (*Pompilus unifasciatus*) died in ten minutes.

Carbonic Acid Anhydride.--Flies (*Musca domestica*) were instantly overcome, and died in from ten to fifteen minutes.

A large blue fly, bluebottle fly (*Musca cæsar*) was in a dying state in two minutes, but revived completely upon its release.

Colorado beetles recovered after three hours exposure during which time they remained upon their backs almost motionless. The surprising vitality of those previously exposed to hydrogen has been given above.

Bed-bugs (*Cimex lectularius*) also recovered to a slight degree after two hours' exposure.

Carbonic Oxide.—Colorado beetles revived after remaining in this virulent atmosphere eight, twenty, thirty and forty-five minutes.

Ants (*Formica rubra*) died in thirty seconds and in one minute.

Prussic Acid Vapors.—This poisonous atmosphere acted fatally upon every insect exposed to it, though the indestructible Colorado beetle resisted its attacks more stubbornly than any other experimented with.

Nitrous Acid Fumes.—These fumes acted with fatal rapidity, and destroyed without perceptible distinctions in the time of their death the feebler and stronger insects.

Chlorine.—Chlorine corrodes and disintegrates the tissues, and

the insects exposed to a dense atmosphere of this gas were immediately killed. It was, therefore, used simply as a diluent of the ordinary air. The Colorado beetles lived in an atmosphere overpoweringly odorous of chlorine for one hour, and partially revived upon their release.

Nitrous Oxide (*laughing gas*).—The Colorado beetle gave in this gas no signs of exhilaration, lived two hours, and died upon removal; probably from exhaustion.

Young of the common grasshopper (*Caloptenus femur-rubrum*) were confined two hours in this gas and were but little affected.

Moths (*Noctua*) died in an hour and a-half.

Illuminating Gas.—The gases used were variable mixtures of hydrogen, marsh gas, carbonic oxide, and hydrocarbons, a notoriously dangerous and irrespirable compound.

Colorado beetles were instantly prostrated, folding up their legs underneath them, and gave in twenty minutes scarcely discernible indications of life. After an hour they were taken out and partially revived; some entirely recovered. The paralysis of the legs was the noticeable feature, especially that of the front pairs.

Croton bugs (*Ectobia germanica*) behaved similarly in the illuminating gases, and on being removed after half an hour's confinement recovered almost completely.

Young of grasshopper (*Caloptenus femur-rubrum*) evinced signs of life one hour after their introduction, and one individual taken out at that time appeared completely lifeless, yet recovered and was sufficiently strong to force its way out from under a beaker glass. Others left in one day were killed.

A cicada (*Cicada pruinosa*) died in ten minutes. Flies imprisoned in these gases, though they instantly fell to the bottom of the jars in an almost lifeless state, recovered after five minutes immersion on being removed. A longer imprisonment dispatched them.

It seems quite feasible that insect cases made air-tight could be charged from time to time with ordinary illuminating gas, and their contents thus protected against the inroads and devastations of Anthreni and Dermestes. Other objects could, of course, be so treated. The cases should be thoroughly tight, and the gas a pure and well-cleaned product. I have kept admirably some specimens in this way, but have noted several aberrant phenomena when specimens were moist. Some fragments of mummy skins, which I had in gas were in excellent condition after a long trial; they had been taken from a decomposing subject. On moistening them a rich growth of Fungi started out over them, which flourished in the atmosphere of gas for a short time, but after repeated charges sickened and died.

I am convinced that in place of ordinary illuminating gas the vapors of Prussic acid diluted with air or pure carbonic oxide, injected into tight insect boxes, will prove most efficacious for the protection of their contents.—*L. P. Gratacap.*

ANTHROPOLOGY.[1]

THE ANTHROPOLOGICAL INSTITUTE.—If we were pained to learn from Professor Flower's presidential address that the Anthropological Institute of Great Britain was on the decline, we are pleased to say that the August number of the Journal is one of the very best that has yet appeared. The original papers are the following:

On the twelve tribes of Tanganjika. By Edward C. Hore.
Notes on the Napa Indians. By Alfred Simson.
Notes on a Patagonian skull. By G. W. Bloxam.
From mother-right to father-right. By A. W. Howorth and L. Fison.
Analysis of relationships of consanguinity and affinity. By A. Macfarlane.
On Aggri beads. By John Edward Price.
On the aboriginal inhabitants of Andaman Is. 1. By E. H. Man.

The twelve tribes of Tanganjika are the Wajiji (Ujiji), Warundi, Wazige, Waviri, Wamsansi, Ubwari, Ugoma, Waguha, Marungu, Itawa, Walungu, Wafipa, Ulcawendi. Of course, Mr. Hore, had to change the initial letter of most of his names from the old spelling, in order to confound our card catalogues.

The Napa Indians are in the "Oriental Province" of Ecuador. There are two classes, *Indians* and *Infidels*. The former speak Quichua, eat salt, and are semi-christianized; the latter, not.

The *Infidels* are the Zaparos, Piojes or Santa Marias, Catos, Tutapishcus, Anhishiris, Intillamas, Meguanas, Copalureus, Tamburyacus, Payaguas, Cuaranos, Pucabarrancas, Lagarto-Cochas and Tagsha-Curarais. The paper of Mr. Simson relates especially to the *Indians*. In it are described the making of the *bodoquera*, or blow-gun, aborginal fishing, social customs, journeys for salt and poison, intoxication, &c.

The paper of Messrs. Howitt and Fison starts out with the following propositions:

1. Many tribes reckon descent through females, others through males.
2. The latter bear evident traces of the former regulation.
3. Where traces appear, uterine preceded male descent.

Changes proceed from causes and motives, that is, from internal and external force. The external theory does not account for the origin of the change, it only pushes it further back. Internal causes or motives are either orderly or disorderly. Orderly changes are produced by the gradual alteration of laws relating to property.

Savage peoples are divided into *Classes* and *Clans*, the former being a social distinction, the latter, local or physical. The *Classes* are further divided into *Totems*. The individuals bearing these totemic names are scattered throughout the clans and tribes, having perpetual succession through mother-right or father-right. Now there is necessarily a conflict between the local and the social, and the extremely interesting and learned paper unfolds

[1] Edited by Professor OTIS T. MASON, 1305 Q street, N. W., Washington, D. C.

the working and interlacing of the two systems among the Australian tribes with which the authors are so familiar.

Mr. Macfarlane, following up the investigations of inquirers into the law and biography of consanguinity and affinity in all times and tribes, seeks to develop a "systematic notation capable of denoting any relationship whatever." There are but two fundamental ideas in consanguinity, the first may be represented by the letters *p* and *c*, meaning parent and child; the other is sex, denoted by the letters *m* and *f*. Mr. Macfarlane shows how the remotest relationship may be indicated by such formulæ as *f p p p p p m*—a man's great, great, great grandmother.

Mr. Man's communication, pages 69–116 is a series of chapters in answer to the British Instructions to Observers, treating of the form and size, anatomy, color, odor, hair, development and decay, crosses, reproduction, abnormalities, pathology, physiognomy, motions, powers, senses, psychology, morals, magic, witchcraft, distribution, topography, communities, arithmetic, habitations, government, &c., of this interesting race.

ASIA.—The volume of Stanford's Compendium of Geography and Travel relating to Asia has just appeared. No ethnologist can afford to exclude these volumes from his library. The series are based on Hellwald's "Die Erde und ihre Völker," but so much original matter has been added that we may well call the series a new work. Already the following are completed: "Australasia," by A. R. Wallace and A. H. Keane; "Africa," by Keith Johnson and A. H. Keane; "Central America, the West Indies and South America," by H. W. Bates and A. H. Keane; and "Asia," by A. H. Keane and Sir Richard Temple, Bart.

Mr. Stanford will soon publish "Europe," by Sir A. C. Ramsay and A. H. Keane, and "North America," by F. V. Hayden, A. R. C. Selwyn and A. H. Keane. It will be perceived that the name of Mr. Augustus H. Keane is attached to each volume; in addition to assuming the main responsibility for the work on Asia, he is the ethnological editor of the series. After the usual amount of preface and introduction (pp. 1–28) the body of the book is divided as follows:

A. Western Asia: Mohammedan States.
B. Southern Asia: British Political System.
C. Northern Asia: Russian Political System.
D. Eastern Asia: Buddhist States.

From chapter to chapter, in its appropriate place, the ethnography of each region is worked out. The term is to be taken in its widest sense, since administration, statistics and commerce are not neglected. In the appendix of this volume, just as in others of the series, especial attention is given to the races and languages of the areas covered by the work. The Asiatic continent exhibits the birthplace of two of the five great families of mankind, the Caucasic and the Mongolic. These two Mr. Keane differentiates as follows:

	Ideal Mongolic Type.	Ideal Caucasic Type.
Shape of head.	Normally brachycephalic.	Normally dolichocephalic.
Facial angle.	Prognathous, 76°–68°.	Orthognathous, 82°–76°.
Features,	Square, angular and flattened.	Rounded off and oval.
Cranium.	1200–1300 cu. cm.	1300–1400 cu. cm.
Cheek bones.	High and prominent.	Low and inconspicuous.
Ears.	Large and projecting.	Small and close to the head.
Mouth.	Large, with lips thick.	Small, with red, thinnish lips.
Nose.	Broad, flat, concave.	Long, narrow, high, straight or convex.
Forehead.	Low, receding, narrow.	Straight, broad, well developed.
Eye.	Small, almond, oblique, &c.	Large, round, straight, &c.
Chin.	Small and receding.	Full and projecting.
Neck.	Short and thickset.	Long, slender and shapely,
Figure.	Squat, angular, heavy.	Symmetrical, slim, active.
Hands and feet.	Rather small.	Medium and large.
Stature.	5 ft. to 5 ft. 4 in.	5 ft. 4. in. to 5 ft. 9 in.
Complexion.	Yellowish, tawny, or olive, &c.	Fair or white to brown, &c.
Hair.	Dull-black, coarse, cylindric.	Wavy, color variable, elliptical.
Beard.	Scanty.	Full, bushy, and often long.
Eyebrows.	Straight and scanty.	Arched and full.
Expression.	Heavy, uniform.	Bright and varied.
Temperament.	Dull, taciturn, &c.	Energetic, restless, &c.

To these two blood-stocks belong as many as thirty language-stocks. In the commingling of history, language and blood have ceased to be coördinate among certain peoples; notwithstanding, on the whole, the radical Aryan forms have been preserved separate from the Mongolian. The following is Mr. Keane's Scheme of the Asiatic races:

I. Mongolic or Yellow Type.

Stock Languages.	*Races.*	*Main Divisions.*
1. Tibeto-Burman	Tibetans	Bod-pa
		Tangutan
		Sifan
		Himalayan tribes
	Burmese	Nó. Assamese
		Burmese
		Kakhyon
		Arakanese
		So. Assamese
2. Khasi		Khasia tribes
3. Mon		Talaings of Pegu
4. Tai	Tai	Siamese
		Shan
		Lao
		Ahom
5. Sinico-Annamitic	Chinese	Chinese
	Annamese	Tongkinese
		Cochin-Chinese
6. Koreo-Japanese	Koreans	
	Japanese	
	Lu-Chu	
7. Ural-Altaic	Finno-Tatars	Mongolian
		Tungus and Manchu
		Turki
		Samoyede
		Ugrian
8. Malayan	Malays	Malay
		Formosan

II. CAUCASIAN OR FAIR TYPE.

Stock Languages.	*Races.*	*Main Divisions.*
9. Kartveli		Georgian and Mingrelian
		Svan, Khevsur, Pshav and Laz
10. Cherkess	Caucasians	Circassian
		Abkhasian
		Kabard
11. Chechenz		Chechenz
12. Lesghian		Daghestan tribes
13. Aryan	Iranians	Tajick
		Baluch
		Kurd
		Ossetian
		Armenian
		Afghan
	Galchas	Zarafshan
		Wakhi
		Siah-Posh Kafir
	Hindus	Panijabi
		Hindi
		Bengali
		Assamese
		Nepalese
		Oriya
		Marathi
14. Semitic	Semites	Assyrian
		Aramæan
		Hebræo-phœnician
		Arab
		Himyantic
		Abyssinian

III. RACES AND LANGUAGES OF DOUBTFUL AFFINITIES.

15. Brahni of Baluchistan.
16. Dravidian } of the Deccan.
17. Kolarian }
18. Sinhalese of Ceylon.
19. Khmer of Cambodea.
20. Aino of Yesso and Sakhalin.
21. Chukchis }
22. Yukaghis } Hyperboreans, N. E. Siberia.
23. Kamchadales }
24. Giliaks }
25. Aborigines of S. W. China.
26. Negritoes of Andaman island, Malacca.

The alphabetic list of races, which terminates each of the preceding volumes of the Stanford series, is omitted for want of space, containing 3000 entries. This list, however, with much additional information, will be issued in a separate form.

ANTHROPOLOGY IN AMERICA.—The Biological Society of Washington has issued its first volume of Proceedings, a neat pamphlet of 110 pages, containing the organization, constitution, list of members, and an account of papers read to May 26, 1882. An excellent feature of this work is one that all societies desiring to economize their means will do well to imitate. Instead of publishing all papers *in extenso*, a reference is given to all places where the whole or parts of papers appear in print.

Mr. Calvin M. Young, of Darla P. O., Ohio, sends to the

editor, a photo of a specimen of the polished ornament commonly called the brooding bird, in which the animal is a turtle, and not a bird. We have seen the beaver taken off in the same way. The turtle-form is exceedingly rare, if it is not the only example. The image was found near a mound in Miami county, Ohio, two miles west of Stillwater river.

Mr. William Kite, of Germantown, Pa., draws attention to the existence of doughnut-shaped stones in Pennsylvania, similar to those so common from California. Mr. Kite says, "I have in my possession two such specimens, one from Chester county, Pa., and one on the outskirts of Germantown. The latter is the more curious, as it has a saucer-like cavity worked on both sides of the stone."

THE AMERICAN ANTIQUARIAN.—The third number of Vol. IV, of this established quarterly is well above the average in merit. The original papers are as follows:—

The native races of Colombia. By E. G. Barney.
The divinity of the hearth. By Rev. O. D. Miller.
Palæolithic man in America. By L. P. Gratacap.
Early European pipes found in the United States. By E. A. Barber.
The Prehistoric architecture of America. By Stephen D. Peet.

The correspondence and notes in this Journal are quite as valuable as the original communications.

GEOLOGY AND PALÆONTOLOGY.

A FOSSIL CROATIAN WHALE (*Mesocetus agrami*)[1].—P. J. Van Beneden, in the "Memoirs of the Royal Academy of Sciences of Belgium," gives an account of the remains of a whalebone whale contained in the museum of Agram, Croatia. These remains are not only of interest from their affinities with existing species, but from the light they shed upon the changes undergone by the European seas since the Tertiary epoch. The Black Sea during that period covered Austria, Bavaria, Wurtemburg, and the lower part of Switzerland, and contained true whales, whereas now its cretacean fauna consists of only three dolphins.

The remains consist of the hinder portion of the cranium, a mandibular condyle, several vertebræ and a part of a rib. The form of the condyle is a mean between that of the existing whalebone whales and that of the dolphins, showing habits intermediate in some respects between these two groups. When the transverse section of the cranium of Mesocetus is compared with that of *Balænoptera rostrata*, a striking difference is observable in form and in the relative development of the bones composing them. The former is spread out laterally at the expense of the height; the sphenoid is at least twice as broad as high, and the palatine plate forms a horizontal cavity under the sphenoid; whereas in

[1]Une Fossile Balenie de Croatie, appartenant au genre Mèsocèto, par P. J. Van Beneden.

the existing species the sphenoid is much higher than wide, and the fold of the palatine is vertical.

ORIGIN OF THE PRAIRIES.—I notice in the AMERICAN NATURALIST for May a note on "The origin of the prairies," in which the Indian custom of burning the grass is made to play a major part. Now, it seems to me, that this may help to account for the slow spreading of forests, but not for the origin of the prairies. Why did not trees spring up over one part of the country as well as another? This is the question; not why did not the forests spread? A reason often given is that the forests flourished only along streams because the prairies are too dry, but the timber often covers the highest points and is not found on the lower ones.

Did not the native grasses cover the ground first and thus prevent all light seeds from finding a place to grow? and as only the light seeds would be transported by the wind, and thus spread rapidly, the extension of the tree-covered areas was very slow.

We observed several years since, that in Northern Ohio trees of the genus Populus, other than *P. tremuloides*, were very rare. Now they are not uncommon. Wherever a brushpile was burned at the proper season, if it was not a period of drought, the cottonwood appeared. The seeds must have come with the winds, and wherever they found soft earth ready to receive them, if the season was favorable, they grew. Of course the oak, hickory, walnut and beech could not travel in this way.

It seems to me that in these facts we have an important element of the solution of this much-debated question.—*J. W. Huett, Ottowa, Ill.*

DAVIS' CLASSIFICATION OF LAKE BASINS.—This is a valuable essay, by Mr. W. M. Davis, on a topic in physical geology which has not before received such detailed and special treatment. It is reprinted from the Proceedings of the Boston Society of Natural History (Vol. XXI, 1882). The author's primary classification of lakes is into three classes: *A.* Construction or orographic basins, of which (1) great basins such as Great Salt lake and the great lakes of Central Africa are examples, (2) mountain trough basins (the western part of Lake Superior), (3) fault basins (the Dead sea and other species); *B.* Destruction or erosion basins, of these are the following species: (1) Glacial erosion basins, (2) wind erosion, (3) solution, (4) pit crater basins; and *C.* Obstruction, barrier or enclosure basins, of which the most important are (1) fan delta barrier basins, (2) ice barriers, (3) moraine barrier basins, (4) drift barrier basins and a number of other species.

The author claims that the Great lakes, the Italian and other lakes, regarded by Ramsay, Logan, Newberry and others as due to glacial erosion, are more properly examples of what he calls "drift barrier basins." He considers that besides the small

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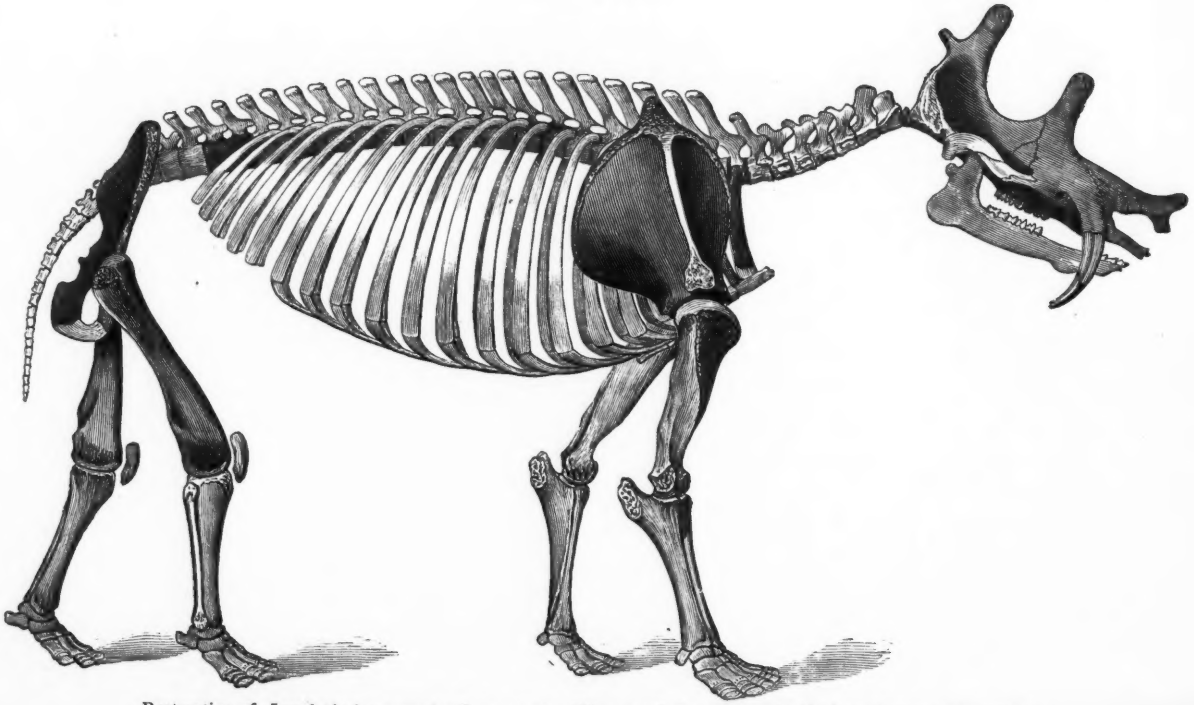

Restoration of *Loxolophodon cornutus* Cope, one-twelfth natural size. From the Bridger Eocene of Wyoming.

moraine barrier lakes, which are now found on Pike's peak, and in the Alps and the north-and-south lakes in Central New York, such as Cayuga, there are many others " whose obstruction must be given the more general name of glacial or fluviatile drift." Farther on he says: " The detritus of the glacial period was deposited with much irregularity, and it must often have interrupted the drainage lines of pre-glacial times; we cannot doubt that the greater number of lakes in Canada, New England and the Adirondacks, are of this origin, but nowhere are drift barriers of more significance than in the region of our great lakes." Davis believes that the evidence ordinarily quoted to prove their glacial origin proves only their glacial occupation. He regards Lake Erie as the effect of simple subaërial erosion slightly modified by glacial action, while he does not feel obliged to regard the other great lakes as the " work of the great ice-plow." He considers St. Mary's river, Niagara and the St. Lawrence to be " all post-glacial overflows after the obstruction by drift and the change of level by northern depression were accomplished." The brief discussion is of a good deal of value, and will be read with interest in connection with the discussions now going on between Professors Newberry, Lesley, Spencer and other of our geologists.

COLLETT'S GEOLOGY OF INDIANA FOR 1881.—This volume is fully equal to if not superior to its predecessors in interest and value, both from a practical and scientific point of view. Mr. T. H. Johnson's report on the transverse strength and elasticity of building stones is valuable and graphically illustrated, and Professor Collett, the State geologist, has been efficiently aided in his work by Messrs, R. T. Brown, M. N. Elrod, A. J. Phinney and John N. Hurty. The volume is largely made up of palæontological matter supplied by Professor James Hall and Dr. C. A White, being illustrated with fifty-five plates, rendering the volume of much educational value.

TWO NEW GENERA OF MAMMALIA FROM THE WASATCH EOCENE. —The *Phenacodus laticuneus* differs from the species of *Phenacodus* in the form of its superior premolars. The second, possesses two cusps while there is but one in the genus *Phenacodus*. The new genus may be called *Diacodexis*. The species referred by me to *Pachynolophus* do not belong to that genus, which is identical with *Propalæotherium*. In the heel of the last inferior molar, and general dental characters, they agree with *Lophiodon*, but they have seven superior molars, the first premolar well developed. The genus may be called *Heptodon*, the type is *Lophiodon ventorum* Cope.—*E. D. Cope.*

WHITE'S CARBONIFEROUS INVERTEBRATE FOSSILS OF NEW MEXICO.—We have received a report, by Dr. C. A. White, printed as an appendix to the forthcoming volume of the Wheeler Survey west of the 100th meridian. The collection described represents

the coal-measure division of the Carboniferous system of the Upper Mississippi, and is closely allied to that upper division of that group.

Geological News.—The Journal of the Cincinnati Society of Natural History contains descriptions of three new species from the Hudson river and Niagara groups, by S. A. Miller; a description of a new species of Bourguetocrinus, by P. De Loriol, of Switzerland, and remarks upon a species of Cristatella, by C. Schlumberger, of Paris, both from the Ripley group of the Cretaceous, Alabama; a description of two new crinoids from the shales of the Niagara group, New York, by E. N. S. Ringueberg, and an article on American Palæozoic Bryozoa, by E. O. Ulrich. The latter is the first of a series, and contains not only descriptions of twenty-five new species, but discourses upon the general structure of the class; upon the affinities and zoölogical position of the Monticuliporidæ and Fistuliporidæ, which the author is inclined to place among the Bryozoa rather than among the Cœlenterata; as well as a scheme of classification of the American Palæozoic Bryozoa. —— M. P. de Tchihatchef, in a discourse delivered at Southampton, combated the idea that the deserts of Asia and Africa are beds of the sea recently raised, and stated his belief that the deposits of sand are of atmospheric origin, and are the product of influences acting from the more or less remote geological epoch, when the rocks from which they were formed, and which in many places still pierce through the superficial sand, were first raised.——J. F. Whiteaves (Am. Jour. of Science, Oct.) notices the occurrence in the Utica formation of *Siphonotreta scotica*, a spinose brachiopod not before known to occur in North America.——Mr. W. E. Abbott, in a paper in the Journal of the Royal Society of New South Wales, refers to and endorses the opinion of Mr. Russell, that the amount of precipitation over the watershed of the Darling exceeds the evaporation plus the amount carried off by the river, and that there must therefore be an underground drainage. The fact that wells sunk in the vicinity of the Darling have a flow independent of the variations in that river, seems to support this opinion.——In the Geological Magazine, Mr. T. F. Jamieson writes in support of the theory, propounded by him in 1865, that the submergence of the land during and after the conclusion of the glacial period was caused by the weight of the ice upon the elastic crust of the earth. The shifting of the centre of gravity of the earth consequent upon the weight, according to the theory of Mr. Croll, will not, in his opinion, account for the existence of raised beaches in high northern latitudes, as at the transference of the weight of the ice from the north pole to the south, and submergence caused by it would cease as the weight diminished, allowing no time for beaches to form. A submergence caused by actual sinking of the crust from superincumbent pressure would, on the contrary return but slowly

to its former level, and probably some amount of permanent depression remained.——In the same magazine, Mr. Woodward describes five species of phyllopod Crustacea from shields found in the Upper Devonian of the Eifel, and one from the Wenlock shale of South Wales; Mr. W. H. Twelvetrees has some notes upon the geology of the country at the base of the southwest slopes of the Urals; Mr. S. V. Wood continues his argument for the formation of the Loess from the sliding into the valleys of the thawed soil-cap annually left unprotected upon the heights: Mr. Howorth adduces the evidence of the valley terraces in favor of the occurrence of a great post-glacial flood; and Mr. Flight continues his history of meteorites.——Among the numerous interesting and valuable papers contained in the Bulletin of the Geological Society of France, during the year 1881, are the following: On the importance of the central chamber of the Nummulites, by M. da la Harpe; On the Micaceous schists of the environs of Saint-Léon (Allier), France, by M. Michel-Lévy; On the connection between the propagation of heat with the cleavage of rocks and the movements of the soil that have produced them, by M. Ed. Jannettaz; Note on the Tertiary Echinidæ of Belgium, by M. Cotteau; On the geology of the environs of Saint-Amand, by M. Dagincourt; The Quaternary of Chelles, by M. Ameghino; Contact of the Bathonian and Callovian beds on the eastern border of the Paris basin, by J. Wohlgemuth; First fruits of the Eocene flora of Bois-Gouët (Loire Inferieur), by M. Ed. Bureau, with descriptions of two new species; On the geology of the Pyrenees of Navarre, Guipuzcoa and Labourd, by M. P.-W. Stuart-Menteath; On the general geology of Spain, by M. P. Rey-Lescure; On the Lingulæ of the "grès" Armorican of La Sartthe, by M. A. Guillier; Geological notes on French Guiana, after the explorations of Dr. Crevaux, by M. Ch. Velain, with a map of the province, and numerous figures of sections of the rocks. The river Oyapock, though only 435 kilometres in length, carries down more water than the Rhone, and the greater portion of its course is among gneissic rocks mingled with granite, which cause numerous cascades, and render its ascent impracticable; Synchronism of the Turonian of the Southwest with that of the south of France, by M. H. Arnaud.

MINERALOGY.[1]

Some New Minerals in Meteorites.—An examination of a mass of meteoric iron from Melbourne, Australia, has been made by Dr. W. Flight,[2] of the British Museum, with the result of the discovery of several new compounds of nickel and iron.

The meteorite, which fell in 1854, consists entirely of metallic minerals, containing no rocky matter. The iron contains 7-9

[1] Edited by Professor H. Carvill Lewis, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

[2] Proc. Royal Soc., No. 218, p. 343.

per cent. of nickel, with small percentages of cobalt, silicium and copper. Lying on the plates of meteoric iron, which make up the mass, are thin metallic flexible plates of the thickness of writing paper of a substance having the composition $Fe_5 Ni_2$. It is this mineral which forms the figures on etched surfaces, and not, as generally believed, schreibersite. The name *Edmonsonite* is proposed for this mineral.

Nodules of troilite and graphite, and square prisms of what appears to be rhabdite ($Fe_4 Ni_3$) P. occur through the mass.

Two other minerals were noticed, and are probably new. One occurs as brass-colored oblique crystals, cleavable across the base, and having a composition agreeing with the formula ($Fe_9 Ni_2$) P_2. Another phosphide whose formula was ($Fe_7 Ni_2$) P. occurred in square prisms, bright externally, and dull, almost black within.

The occluded gases in the meteorite amounted in bulk to 3.59 times the volume of the iron, and consisted of carbonic acid, 0.12; carbonic oxide, 31.88; hydrogen, 45.79; marsh-gas, 4.55; nitrogen, 17.66.

Corundum and its Alterations.—Dr. F. A. Genth has made another valuable contribution to our knowledge of the genesis of minerals in a paper read before the American Philosophical Society, on August, 18, 1882. The paper is in part an appendix to his former paper on corundum and its alterations, and in part a collection of mineralogical notes on various subjects.

Of the alterations of corundum, the first described is an alteration into spinel of the corundum from Carter mine, Madison county, N. C. When containing fissures, it was observed, sometimes only by a small dark line, that a change had commenced, which, extending sometimes through large masses, had converted the corundum into a massive greenish-black spinel of granular structure. The spinel finally passes into prochlorite. Particles of spinel were also observed in corundum from Shimersville, Lehigh county, Pa., and were regarded as the result of alteration. At Toures county, Ga., corundum was surrounded by an alteration into greenish-white, cleavable zoisite.

Several examples are given of the alteration of corundum into feldspar. The oligoclase of Unionville, Pa., is regarded as such an alteration. A number of instances are given of alteration into mica. A specimen from Haywood co., N. C., showed a large crystal of muscovite to which albite was attached, while through both substances there occurred remnants of corundum crystals, disseminated through the mass. The particles of corundum are corroded as though by a dissolving agent, and the whole mass has the appearance of a coarse granite in which corundum replaces the quartz. In some specimens from Alabama, the corundum crystals are surrounded by a layer of sub-fibrous mica, outside of which is a fine scaly mica, much of which has changed into brown scales, which exfoliate when heated. The corundum is rounded and corroded,

but the sub-fibrous mica forms a ring around it with perfect hexagonal sides and sharp edges. Many of the crystals are almost completely changed into compact mica.

Several new localities are given of the alteration of corundum into margarite, fibrolite and cyanite. The interesting fact is recorded, that since these alterations of corundum occur in rounded masses in the gravel beds of the Southern States, the alterations here described must have taken place prior to the formation of the graveldeposits.

Of other alterations, those of orthoclase into albite, and of talc into anthophyllite are described. Some very interesting pseudomorphs of talc after magnetite, from the great serpentine bed in Harford county, Maryland, were observed. Octahedrons of talc, of a white color and pearly lustre, had the scales arranged parallel to the octahedral planes, and sometimes contained a nucleus of magnetite, more or less altered. Dark spots often of definite shape occur throughout the steatite bed, and it is suggested that the entire steatite bed is an alteration from one of magnetite.

Analyses are given of gahnite from North Carolina and Colorado, and some alterations of the latter into a chloritic mineral are described.

Minute grains of rutile and zircon were detected in the "Edge Hill rocks," of Bucks county, Pa. Small crystals of sphalerite and prehnite from Cornwell, Pa., are analyzed and described. A compact variety of pyrophyllite, having the appearance of kaolinite, and not exfoliating when heated, was described as occurring in seams in the slates and anthracite of Drifton, Luzerne county, Pa. Analyses of beryl and allanite from Alexander county, N. C., and of niccolite from Colorado are given, and some octahedral, cavernous crystals from a furnace bottom at Argo, Colorado, are shown by analysis to be probably artificial alisonite.

The paper contains numerous analyses which are especially valuable from the well known accuracy of Dr. Genth's work.

THE PARAGENESIS OF MINERALS.—The study of the origin, successive formation and repeated alterations of minerals, is one of the most fruitful branches of mineralogy. As such studies progress, the science becomes more generic, and, entering a broader field, ranks with geology in unfolding the cosmogonic truths.

Of recent mineralogical papers, one of the most important is that by Professor B. K. Emerson[1] on the minerals of the Deerfield Dyke. Not only is each species carefully described, but its precise method of occurrence and of association with other minerals is given so as to show its comparative *age*. A table is added which shows at a glance the paragenesis of the species found.

Chemical analyses were not needed to establish the results obtained, and the mere inspection of the locality with the exact description given, is of far greater value than any list of chemical

[1] Amer. Journ. Sci., Nov., 1882.

analyses, such as would have contented most writers, while chemical analyses are often needed to establish the identity of a species. The broader study of the *origin of species* can be done by close observation alone.

The attention of our younger mineralogists should be particularly called to the value of a full description of the *associations* of minerals. The selected specimens in our cabinets, from which all "dirt" has been removed can teach us nothing of their origin. It is the rough masses in their natural home, interpenetrated by more recent minerals, or occurring in veins in those which are older, which, with their products of decomposition, are most worthy of study, both macroscopically and microscopically. A study of mineralogical development may finally lead to a new basis of classification, such as has already been attempted in lithology.

A MOUNTAIN OF MARTITE.—An iron mountain, the Cerro de Mercedo, which rises abruptly out of the plain near the city of Durango, Mexico, and which, a mile in length, is so covered by masses of iron ore as to conceal all rock outcrops has been reported upon by Mr. John Birkenbine, and the ore further described by Professsor B. Silliman. The ore has the streak and composition of hematite, but the octahedral character of the crystals showed it to be martite, and it is probable that the whole mass has been altered from magnetite.

ANALYSIS OF HELVITE.—Mr. R. Haines contributes to the Franklin Institute Journal, a correction of his analysis of the Helvite, from Amelia Co., Virginia, found by the writer and first recorded in the April NATURALIST. A re-examination of the specific gravity showed his first determination to have been erroneous, owing to the small amount of material at hand. It is now found to be 3.29. A new analysis gave total SiO , 32 49 per cent. of which 5.17 per cent. was insoluble in sodic carbonate, and is regarded as gangue. The full analysis was not completed.

GEOGRAPHY AND TRAVELS.[1]

PROCEEDINGS OF THE GEOGRAPHICAL SECTION OF THE BRITISH ASSOCIATION.—The meeting of the British Association for the Advancement of Science, this year, was held at Southampton, from August 23d to 30th.

The subject of the opening address of the president of the Geographical Section, was the Central Plateau of Asia.

"Thi area," he said, "which is one of the most wonderful on the surface of the earth, contains nearly 3,000,000 of English square miles, and is equal to three-fourths of Europe. Its limits, its exterior configuration, its central and commanding situation in the Asiatic continent, will be clearly perceived from the large diagram of Asia which is exhibited here. As compared with some of the more favored regions, it is singularly destitute of natural advantages. Though it has several deep depressions of surface, yet its general elevation is very considerable, and some of

[1]Edited by ELLIS H. YARNALL, Philadelphia.

its large districts are the most elevated in the globe. It is walled in from the outer world and excluded from the benign influence of the sea by mountain chains. Its climate then is very severe on the whole, more distinguished for cold than for heat, but often displaying extremes of temperature high as well as low. It offers from the character of its contour, extraordinary obstacles to communication by land or or water. Though seldom inaccessible to courageous explorers, it is generally hard of access, and in several respects very inhospitable. In the progress of civilization it is, with reference to its historic past, excessively backward. Its capacities for the production of wealth have been but little developed. Its population is scanty, scattered, and uncultured. Its agriculture comprises only a few areas widely segregated from each other, and many of its largest districts are amazingly desolate. Nevertheless this plateau has eminent claims on the attention of geographers, for several reasons, which may be summarized thus :—1. A mountain system which dominates the greater part of Asia, and includes stupendous ranges with the loftiest peaks yet discovered in the world. 2. A series of heights and depressions almost like the steps of a staircase within the mountainous circumvallation of the plateau. 3. The sources and the permanent supply of rivers which, passing from the plateau, flow through densely populated regions, and help to sustain the most numerous families of the human race. 4. A lacustrine system, comprising lakes, of which some are saline while others have fresh water, and of which many are situated at great altitudes. 5. The home of conquering races, whence warrior hordes poured during several centuries over nearly all Asia and a large part of Europe. 6. Natural products of value, variety, or interest, and pastoral resources susceptible of indefinite development. 7. An enormous field for scientific research, with many regions which, though not wholly undiscovered, yet need much further discovery. 8. An imperial jurisdiction offering many problems for the consideration of social inquirers."

The consideration of these points in detail occupied the remainder of Sir R. Temple's address.

Mr. John Ball discussed some points of the physical geography of South America, and especially the "remarkable contrast that exists between the climate of the eastern and western sides of the continent. On the eastern side of the great range of the Andes, which extends from north to south, a distance of more than 3500 English miles, you find throughout the vast empire of Brazil, from some degrees north of the equator to the tropic of Capricorn, copious rains which maintain extraordinary fertility and the full luxuriance of the tropical fauna and flora. On the opposite or western side, the tropical climate, with its characteristic vegetation, extends to the Pacific coast from the Isthmus of Panama to the Bay of Guayaquil. But the headlands which mark the southern limit of that bay—Capes Parinas and Blanco—also mark a sudden and complete change of climate. From the latter cape, lying about five degrees south of the equator, the comparatively narrow strip of land lying between the Andes and the Pacific coast—for a distance of fully 1500 miles—lies in what has been called the rainless zone of Western South America." Again, "in the southern province of Brazil and thence southward to the estuary of the Plata, the climate shows a gradual transition from the moist tropical type to the dry character of the *pampas* region, which in a more marked degree prevails in the south of the Argentine territory and through Eastern Patagonia. Exactly an opposite change occurs on the western side. In Chili, from Copiapo, where rain is rare and insufficient, to Valdivia, where it is excessive in amount, there is, as you travel

southward, a gradual and steady increase in annual rainfall, with a corresponding change in the vegetation. The coast south from Valdivia, extending throughout Western Patagonia to the western end of the straits of Magellan, is apparently the part of the earth out of the tropics where the annual rainfall is greatest."

At Tumbez, on the south side of the Bay of Guayaquil, are frequent heavy rains and a mean temperature of about 82° F., with rich tropical vegetation; whereas at Payta, scarcely a hundred miles distant, no rain falls for two years at a time, and the average temperature is much lower than at Tumbez, while the coast is absolutely bare of vegetation.

The mildness of the climate, and especially of the winter climate, of the straits of Magellan is also without adequate explanation.

Mr. Joseph Thomson read a valuable paper on the Geographical Evolution of the Tanganyika Basin.

The various stages in the evolution of the Tanganyika Basin were summarized as follows:—"The first appearance of the future continent, we have been led to believe from various theoretical considerations, was the appearance of a fold of the earth's crust bounded by two lines of weakness converging towards the south, which fold gradually rose till it appeared above the ocean, first along these two lines of weakness, in the form of a series of islands, which finally join, enclosing in their centre a large part of the ocean. This enclosed water area formed a great central sea, and the enclosing land along the line of weakness is now indicated by the east and west coast ranges. In the second stage the continent of Africa south of 5° N. latitude presented the outline of the continent of to-day. The third stage shows the central plateau with the great central sea very much diminished in size and almost coinciding with the present Congo Basin. There is as yet no evidence of the existence of Tanganyika. After an enormous period of undisturbed deposition of sand in the sea, the fourth stage is ushered in by a period of great continental convulsions. On the line of the future Tanganyika a huge boss of rock is intruded into the throbbing crust, and the surrounding region elevated to a considerable extent, followed by the subsequent collapse of the body of the elevated area originating the great abyss of Tanganyika. The fifth great stage is marked by the formation of a channel through the western coast mountain causing the draining of the great central sea, which immediately becomes the inner drainage area of the Congo. The sixth stage then sees Tanganyika isolated as a lake by itself, from which time dates the moulding of its present scenery, the formation of an outlet, the freshening of its waters, and the lowering of its level; and, finally, we have seen that the intermittency of the lake's outflow is explained by the probable fact that the rainfall and evaporation nearly balance each other in ordinary seasons."

One of the most learned and elaborate papers was by M. P. deTchihatchef, on the Deserts of Africa and Asia.

After treating at length of the geology and physical changes of the desert of Sahara, he gives the following resumé of the most prominent features in its geological history:—

"1. The records of this history are very old, for the southern regions of the present Sahara were represented during the Devonian period by a certain number of isolated masses of limestone, gneiss, and micaschiste, the limestone containing Devonian fossils. Those masses conserved through all the succeeding ages their insular position, and never sunk again under the sea. 2. It was during the Cretaceous epoch that a large portion of the present Sahara was upraised under the shape of variously ramified masses, so that the sea of the following geological periods could penetrate into their interior, forming numerous gulfs and bays. 3. The Sahara was represented until the Quaternary epoch chiefly by those cretaceous masses which since their upheaval have never been covered by the sea.

"During the Quaternary period, among the gulfs which washed the shores of the cretaceous land, the largest occupied the present country of Jgharghar; the northern extremity of that gulf reached the place of Biskra, and the southern the cretaceous plateaux of Tademayt and Tinghert; the town Uargla occupies almost the central part of the gulf. As from the north, the last was entirely secluded from any communication with the sea, the littoral part of Algeria having been upraised a long time before, and consisting then, as now, in more or less high mountains, the large quaternary gulf could not find any other way in the interior of the Saharian cretaceous continent than through the present gulf of Gabe; and what proves that here was really the entrance of the quaternary gulf, is the narrow strip of diluvial deposits which, surrounded by cretaceous rocks, extends from Gabes unto the salt lake of El-Fedjedj (Tritonis lacus). This geological fact is important in reference to the question, so long discussed, of the ancient communication between the lake and the sea; it confirms the hypothesis of Commander Roudaire, and I am not aware that this argument, which I consider as the strongest of all, has ever been urged in his favor. The upheaval of the quaternary large gulf (and of many other smaller ones) was the last marine phasis which the Sahara underwent. 4. Once entirely raised up in all its parts, the Sahara had still to undergo a subaerial operation which consisted in the formation and accumulation of sands. It closes the fourth and last stage of her long geological history, without speaking of the different climatic and topographical modifications of quite recent times. This history, as it has been shown, proves that there can be no longer question of a recent emersion of the whole Sahara from the bottom of the sea. It is true the Libyan desert is probably somewhat younger than her Saharian sister, for tertiary uncovered deposits (Eocene and Miocene) have there a larger development than the Cretaceous ones; but, even admitting that the Libyan desert has been upraised after the Miocene period, it cannot be called recent."

As regards the great desert of Asia—the Gobi, there is abundant evidence to show its ancient formation, and it is "probable that after its upheaval this large surface has never been overflooded by the sea, as little as the Sahara-Libyan desert since the Cretaceous and Tertiary periods, or the Turkestan deserts since the Palæozoic epoch. Once more, in the Gobi, as in the other two deserts, the sand accumulations had nothing to do with marine deposits; they were chiefly produced by atmospheric agencies, and, as far as the Gobi is concerned, the frequent silicious rocks, as granite, syenite, gneiss, &c., were particularly apt to yield sufficient materials to the formation of quartz sands. It is superfluous to add that the upheaval of those deserts did not take place at once, but successively, as we have seen in the Sahara-Libyan desert, where Cretaceous and Tertiary rocks appeared, the one after the other, leaving still large tracts occupied by sea or fresh water basins, which were filled up only during the Quaternary epoch, or even in a more recent one. Therefore it is highly probable that, like the Sahara-Libyan desert, the Asiatic deserts were also crossed, long after the upheaval of their chief portions, by gulfs, or contained numerous fresh water basins."

The Geography and Meteorology of Kansas was treated of by Dr. Litton Forbes. It would be impossible perhaps, to find a country of equal extent where the physical changes produced by the advent of civilization have been so numerous or so important. Not only has the fauna been in great part changed, but the flora also, as well as the amount of rainfall and the general hygrometric conditions of the atmosphere. Not merely has the number of inches of annual rainfall increased, but it has also been more equitably extended over a larger extent of country. The progression westward of the rainfall of Kansas, in proportion as settlement has extended westward, is a most important fact. It may be due in part to the planting of timber, but is probably much more directly dependent on the immense acreage under wheat, corn, and other crops, which afford protection to the earth from the sun's rays, and so check a too rapid evaporation.

The State of Kansas forms a rectangular parallelogram, which measures about 400 miles from east to west, and about 200 from north to south, and contains over 82,000 square miles. Though to the eye apparently one vast, level plain, it is really a more or less elevated plateau, which slopes eastward at an appreciable angle. The highest, or western portion of the State, is about 4000 feet above the level of the sea, while the average height of the whole country may be placed at about 2375 feet. The main water course is the Arkansas river, which has a fall of about six feet in the mile. In spite of the absence of hills, Kansas is singularly free from marshland or swamps. This is due, in part, to the friable nature of the soil, and in part to the natural slope of the land towards the east. What is known as the "Great Arkansas Valley of South-western Kansas," embraces a width of fifty miles, nearly the whole of which is sloping upland. The soil here is a sandy loam, of alluvial origin, and of great depth and fertility. A remarkable peculiarity of the Arkansas river is that it never overflows its banks, but, so to say, underflows them. The water filters through the gravelly stratum underlying the surface-soil of the valley, and may always be found by digging for it. From a meteorological point of view, Kansas may be said to be divided into three distinct zones, marked off by the amount of rainfall. In the extreme east the rainfall assimilates itself to that of Missouri, and is ample for all purposes of agriculture. In the middle zone, which may be said to lie in Central Kansas, the rainfall is less, yet amply sufficient for all purposes of farming or pasturage. The vegetation here is extraordinarily profuse, and is sub-tropical in character. The third and last zone lies in the western and south-western portions of the State. Here the climate resembles that of Colorado, and the rainfall is insufficient for agriculture, though sufficient for grazing purposes. It would seem, however, that the limits of the zone of moderate rainfall are constantly proceeding westward as civilization advances. Twenty five years ago the frontier of agricultural production was placed at about the ninety-sixth degree of west longitude. Ten years later it had advanced to the ninety-seventh, five years later to the ninety-eighth, while to-day it may be said to extend to the one hundredth. Along with this advance the character of the flora of the country has appreciably changed. The "blue stem" grass and other plants, which require moisture, have displaced the buffalo or "gramma grass," which is the natural covering of the great plains. Whether the procession westward of the rainfall will continue as heretofore, once it has reached the meridian of 100°, may fairly be open to question. The prevailing winds from May to September are from the south and south-west. But inasmuch as the western limit of the Gulf of Mexico is in the ninty-eighth meridian, it follows that these winds must blow over the arid and thirsty soil of Mexico, and will contain therefore but little moisture. Hence this west-

ern part of Kansas must long continue to be an essentially dry country. Cultivation may no doubt modify the climate, but the process will be slower and more difficult than in Central Kansas.

POGGE AND WISSMANN.—Letters have been received from Dr. Pögge, dated November 27, 1881, written at Mukenge, the residence of the chief of the Tusselanga in about 6° S. lat. and 22° 22′ 10″ E. long. (Greenwich). The travelers had, in turning the territories of the Muata Yanvo, been obliged to take a northeasterly direction and after forty-four days' march from Kimbunda crossed the Kassai on the 21st of October. The Kassai at this point had a width of about 350 yards. Here Wissmann separated from his companions and started in a southerly direction, whilst Dr. Pögge took a northerly course towards the territory of the Tusselanga, reaching on the 30th of October, the residence of the chief Kalamba Mukenge. This place, with its well built huts and population of about 1000 souls, lies between the sources to two rivulets flowing towards the Lulua, and having excellent drinking water, and would form a capital site for a station if the Lulua should prove available for water communication with the yet unknown regions beyond. But it appears that this river, notwithstanding its breadth of more than 300 yards, is very shallow and full of rapids. Pögge describes the country as fertile; every where madioca, maize, millet, and beans are cultivated, and the four kinds of oil palms, which grow chiefly in the forests, are seen planted in the cultivated fields. Of game animals occur only the wart-hog and a small species of Cape buffalo, but the rivers are full of hippopotami and the woods of various species of *felidæ*. The grey parrot is also found here. The climate is warmer than in the Muata Yanvo's country, but everywhere salubrious and the natives are friendly and peaceable. The chief articles of trade are slaves, especially female, and india-rubber; ivory being little dealt in. The chief market for ivory lies some eight days' journey to the N. N. W. of Mukenge at a place called Kabao, in the Tukette country.

With regard to his further movements, Dr. Pögge hoped to leave Mukenge on the 29th of November and to cross the Lulua and meet Lieut. Wissman in Bacua-Carimba. Both would then, under the protection and guidance of the chief Kalamba-Mukenge, travel eastward as far as the Lake Mukanga, distant ten days march, and then onward six days march to the Mobondi-Stani, further two days' march to the Lubilash river, and two days beyond that, to the great Mobondi chief Fumo-Kole. As far as that point only was the traveler able to obtain information regarding the route. Should no insuperable obstacle be encountered, the travellers would travel along the trade road leading to Nyangwe on the Lubilash (the upper course of the Congo,) reaching which place Pögge would return to Mukenge whilst Wissmann would strike

for Zanzibar. Pögge calculates that his journey to the Lubilash and back to Mukenge will take six months.

AFRICAN EXPLORATION.—The Royal Geographical Society has decided to send a new exploring expedition to Africa under the command of Mr. Joseph Thomson. After organizing his company at Zanzibar, Mr. Thomson will proceed from Mombas on the East African coast to Mount Kilimandjaro, and after ascending this celebrated peak, he hopes to advance through an entirely unknown region to the shores of the Victoria Nyanza, returning to the coast by a more northerly route so as to visit, if practicable, Lake Baringo and Mount Kenia.

Lieutenant Giraud, a young French naval officer, has sailed from Marseilles for Zanzibar. He intends to go either to Lake Tanganyika, or more probably by the north shore of Lake Nyassa, to the Chambeze River. He will follow this stream to its outlet in Lake Bangweolo, which he proposes to circumnavigate. He then hopes to descend the Lualaba-Congo to the sea.

The French Government has decided against the scheme of M. Roudaire of flooding a portion of the Sahara, considering that the cost will exceed the advantages to be gained.

Professor Guido Cora in an address before the Italian Geographical Society, describes the Desert of Sahara as an immense tract of country, with a mean elevation of from 1300 to 1650 feet above the level of the sea, in which sand does not occupy more than one-fifth of the entire area, and where large chains of mountains are found attaining a height of from 6550 feet to 8200 feet. In some parts it only rains once in some twenty years, while in others there is a regular rainy season; the temperature there rises to 122° F. and falls to 19° 4′ F., and the loftiest mountain tops are covered with snow and ice for several months in the year. The fauna and flora have a special importance. Lastly, the Sahara has a population of some 3,000,000, and contains towns of from 5000 to 10,000 inhabitants. It has a total area of 3,700,000 square miles, stretching on the north to the Great Atlas and the Mediterranean, between the two Syrtes to the south of Cyrenaica and Lower Egypt; on the east it is conterminous with the Valley of the Nile; on the south it is bounded by a line running from El Obeid to Lake Chad, to the middle course of the Niger, and the lower part of the Senegal; and lastly, on the west it reaches the Atlantic Ocean.

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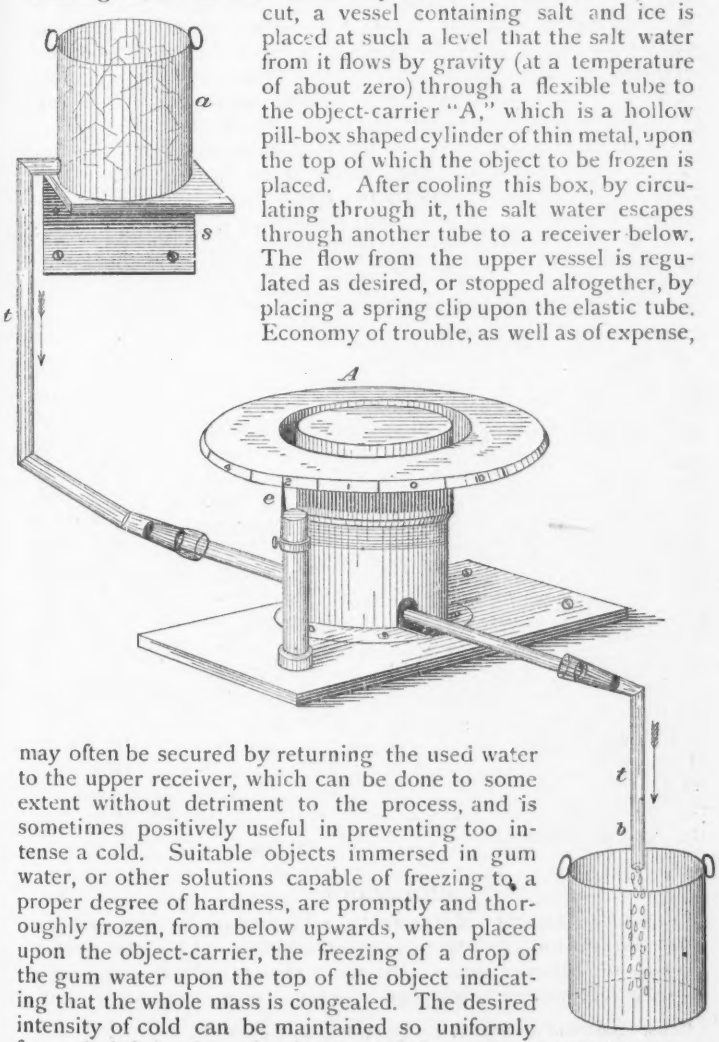
MICROSCOPY.[1]

TAYLOR'S FREEZING MICROTOME.—All who are familiar with the exquisite sections of soft tissues, sometimes cut by the various freezing microtomes, and at the same time have had experience of the troubles, uncertainties and delays (if not dangers) of pack-

[1] This department is edited by Dr. R. H. WARD, Troy, N. Y.

ing ice and salt in little spaces close to the object, or pumping the spray of rhigolene or ether, will be glad to welcome a contrivance fitted to give the best results in cutting frozen tissues with uniformity, certainty and ease. The microtome recently contrived by Thomas Taylor, M.D., of the Department of Agriculture, at Washington, seems able to accomplish this. As shown by the cut, a vessel containing salt and ice is placed at such a level that the salt water from it flows by gravity (at a temperature of about zero) through a flexible tube to the object-carrier "A," which is a hollow pill-box shaped cylinder of thin metal, upon the top of which the object to be frozen is placed. After cooling this box, by circulating through it, the salt water escapes through another tube to a receiver below. The flow from the upper vessel is regulated as desired, or stopped altogether, by placing a spring clip upon the elastic tube. Economy of trouble, as well as of expense,



may often be secured by returning the used water to the upper receiver, which can be done to some extent without detriment to the process, and is sometimes positively useful in preventing too intense a cold. Suitable objects immersed in gum water, or other solutions capable of freezing to a proper degree of hardness, are promptly and thoroughly frozen, from below upwards, when placed upon the object-carrier, the freezing of a drop of the gum water upon the top of the object indicating that the whole mass is congealed. The desired intensity of cold can be maintained so uniformly for an indefinite time, that hasty work in cutting, which is essen-

tial to the best work of many freezing microtomes, and the characteristic advantage of some of the best of them, is not required. The cutting knife is supported upon a circular plate, which screws up and down around the object, the extent of its motion, and the consequent thickness of the section to be cut, being indicated by a pointer near its graduated edge. The best of workmanship is required in this screw, but it can be made so firm and yet so easy as to give excellent work. It is evident that the Biscoe form of knife-carrier could be easily adapted to this instrument by those who prefer it. The standard size of the instrument cuts sections up to one inch wide, and costs $15.00, or with rubber tubes, clips and tin pail, $15.50. A special size is being made for cutting much larger sections, which will probably cost about $20 00. The instruments can be obtained from A. R. Taylor, 328 Massachusetts avenue, Capitol Hill, Washington, D. C.

Relation of Aperture and Power.—In the Journal of the Royal Microscopical Society, Professor Abbe gives an elaborate and exhaustive mathematical demonstration of the apertures useful for various powers. His conclusions favor extreme angles for high powers, economy of aperture for medium powers (the loss of penetration, working distance, &c., in superabundant aperture being always a disadvantage greater than the possible benefit), and considerable latitude for low powers, where a surplus aperture of 100 per cent. higher than that required for delineation, may be useful for illumination. A similarly conservative position was taken by Dr. Wm. B. Carpenter, in his able and highly appreciated address on the subject, at the Montreal meeting of the A. A. A. S. He preferred moderate angles for most purposes, even for high powers, and wholly condemned the fashion of attempting, by unduly high angle, to force a low power objective to do the work of a high one. Such a lens will resolve tests, but its use is trying to the eyes. It is useless to spoil a good one inch by trying to make it a poor one-fourth. On the other hand, Mr. Geo. E. Davis, in a lengthy editorial in the *Northern Microscopist*, urges the use of much higher angles than would be admitted by Professor Abbe's theories, and he would only select low angles when cheapness was obligatory. His ideal series is a 2 inch of 20° or more; a 1 inch of 35° or 40°, with a working distance of 0.40 inch; a ½ inch of 66° or 70°, working distance 0.10 or 0.12 inch; a ¼ inch of 100°, and higher powers as required. He claims that objectives by Tolles, Beck, Ross, and Wray, stand reduction of aperture by means of the iris diaphragm shutter remarkably well, though those of Zeiss, made from the formulas of Professor Abbe, do not. (Conf. discussion at Manchester, Mic. Soc., in the *Northern Microscopist*, Vol. 2, pp. 284-291.)

Visibility of Fine Rulings.—Professor W. A. Rogers, in a paper before the A. A. A. S. considers Mr. Fasoldt first in the art

of micrometric ruling, since the death of Nobert; but his plates as high as 100,000 to the inch, have not been photographed, and the resolution of 152,000 to the inch, though believed by some, has not been proven. Single lines $\frac{1}{50000}$ of an inch wide are readily seen by the naked eye, and those one-third as wide may be seen without the microscope. Lines too fine to be seen singly with the microscope can be seen and resolved if ruled close together in bands.

Cutting Sections of Coal.—The discussion in the English journals as to the correctness of the assertion in the Micrographic dictionary, that coal can be softened by soaking in a solution of carbonate of potash, sufficiently to be sliced with a razor, has ended with the concession that it is lignite, and not coal, that can be so prepared. The use in the dictionary of the word coal, in this special and not usual sense, has caused many and perplexing failures to experienced workers as well as to beginners.

Microscopical Diagnosis.—Under this title, Professor Charles H. Stowell, of the university of Michigan, has brought out an octavo volume of 250 pages. The book, which is published by Geo. S. Davis, of Detroit, at $3 00, is well printed and freely illustrated with wood cuts and lithographs. Its character is not well indicated by its name. It consists of a collection of essays upon a variety of subjects, having in many cases little relation to each other, and no special connection with the technical subject announced in the title. Part I, of 93 pages, relates (with the exception of the chapter on starch, which seems to belong to Part II) to medical microscopy, with especial reference to questions of diagnosis. It is the portion which gives name to the book, and after an introductory chapter on the instrument, treats of blood, epithelium, sputa, etc., muscle, urinary deposits, parasitic diseases of the skin, tumors, starch, and staining of blood. The chapters upon urinary deposits and tumors are particularly full, the former being illustrated by eight lithographs, very carefully and accurately drawn by Mrs. Stowell. Part II, of 118 pages, is a series of excellent studies in vegetable histology by Mrs. Stowell, the objects selected being of medicinal or economical importance, and the observations having frequent reference to the question of adulterations. By far the most prominent and interesting portion of this Part, is the "Study of Wheat," reprinted from the *American Miller*. The other chapters of this part relate mostly to medicinal plants, and were originally produced in various journals. When supplemented, as proposed by Mrs. Stowell, by a series of similar studies of the more important medicinal plants, this collection will become a treatise of great importance and interest Part III is the series of very instructive and popular papers on the preparation and mounting of microscopic objects, originally published

by Wm. H. Walmsley in *The Microscope*. It forms a convenient appendix to the volume.

THE HOUSE-FLY AS A CARRIER OF CONTAGION.—This subject, which has attracted some attention of late, was discussed by Dr. Thomas Taylor, of Washington, at the Montreal meeting of the A. A. A. S. Having noticed a species of anguillula within the proboscis and abdomen of dissected flies, he undertook a series of experiments to determine whether the house-fly might not be a carrier and distributor of germinal virus of various kinds. The suction tube of the fly was found by measurement to be of sufficient diameter to admit of taking up the spores of cryptogams, trichina, the eggs of anguillula, or even the anguillula themselves. Thirteen specimens of anguillula were found in the proboscis of a single house fly, and sixteen acari in the thorax of another. Furthermore, flies fed with the spores of the red rust of grasses, mixed with sugar, swallowed it freely, and also carried about the spores attached to the hairs on their limbs. The fact that by far the greater part of the spores were consumed, and digested without germinating, suggested to the author that the flies might thus be destroyers of microscopic germs as well as disseminators of them. Dr. Leidy made similar observations some years ago.

RECENT MICROSCOPICAL PAPERS:—

Micro-organisms from Rainwater, Ice, and Hail. (Discussing the question of Bacteria in the air and as a cause of disease.) R. L. Maddox, M.D., in *Journ. Royal Mic. Soc.*, Vol. II, p. 449.

Simple method of determining Angular Aperture. Ernst Gundlach, in *Am. Month. Mic. Journ.* Vol. III, p. 176.

Development of the Planula of *Clava lepto tyla* Ag. J. H. Pillsbury (Montreal Meeting A. A. A. S.), in *do.* p. 181.

A New Thericola. Dr. A. C. Stokes, in *do.* p. 182.

The Microspectroscope. Romyn Hitchcock (at N. Y. Mic. Soc.), in *do.* p. 183.

New Constant Pressure Injection Apparatus. Professor Wm. Libby, Jr. (at A. A. A. S.), in *do.* p. 187.

Physiology of Variable Apparent Magnification by the Microscope. W. LeConte Stevens (at A. A. A. S.), in *do.* p. 189.

Some Vegetable Poisons. (Observations and Experiments in regard to Bacteria in poisonous plants). Professor T. J. Burrill (at A. A. A. S.) in *do.* p. 192.

Proboscis and Labial Palps of the Oyster. H. J. Rice, in *The Microscope*, Vol. II, p. 117.

Occurrence of Red Snow in Hertfordshire. R. B. Croft, R. N., in *North. Microscopist*, Vol. II, p. 249.

Life Histories and their Lessons. Rev. W. H. Dallinger, in *do.* p. 263.

Spiders; their Structure and Habits. William Horner, in *Journ. Postal Mic. Soc.*, Vol. I, p. 63, etc.

Photo-micrography. (Popular description of apparatus and methods.) Harry Barker, in *do* p. 75.

Foraminifera; How to Prepare. Charles Elcock, in *do.* p. 25 and 139.

Œtiology of Tuberculosis. (A full and excellent summary of Koch's observations and experiments upon the Bacteria of tuberculous disease.) Wm. F. Whitney, M.D., 16 pp., Cambridge, 1882. Reprinted from *Boston Med. and Surg. Journ.*

Communicable Diseases. (A popular account of the germ theory of disease. Geo. E. Blackham, M. D., in *The Bistoury*, 1882, p. 163.

Alternation of Generations among the Uredines. Charles B. Plowright, in *Sci. Gossip*, 1882, p. 196.

SCIENTIFIC NEWS.

— *Nature* for Sept. 28th, publishes, in full, a translation of the eloquent address of Professor Haeckel, at the Eisenach meeting of the German naturalists and physicians. After paying tribute to Darwin's theory of natural selection and the wide influence it has exerted on human thought, also giving his personal impressions of Darwin, when he first visited him in 1866, he then endeavors, and with good success, to prove that Goethe was an evolutionist. Haeckel then gives very full credit to the views of Lamarck, whose merits have been quite kept in the dark by some English Darwinians. "We cannot," says Haeckel, "but regard it as a truly tragic fact, that the 'Philosophic Zoologique,' by Lamarck, one of the greatest productions of the great literary period in the beginning of our century, met, from its outset, with but extremely little attention, and in the course of a few years was utterly forgotten. Not till Darwin, fifty years later on, breathed new life into the transformation theory therein established, was the buried treasure again brought into the light of day, and we cannot now but describe it as the completest representation of the theory of development prior to the time of Darwin."

Haeckel's monistic views, as he states them in this address, appear to be nearly identical with the agnosticism of Herbert Spencer—"that purest monistic form of faith," says Hæckel, "which attains its climax in the conviction of the *unity of God and nature*." The further advances we make in the knowledge of nature — "the more we approach that unattainable, ultimate ground—the purer will be our idea of God."

Haeckel then explains his views, uttered five years ago, as to the teaching of Darwinism in the lower schools, which had been misunderstood. "It stands to reason with these words I could not mean to claim that Darwinism should be taught in elementary schools. That is simply impossible. For just like the higher mathematics and physics, or the history of philosophy, Darwinism demands a mass of previous knowledge which can be acquired only in the higher stages of learning. Assuredly, however, we may demand that all subjects of education be treated according to the *genetic method*, and that the fundamental idea of the development theory, the *causality of phenomena*, finds everywhere its acknowledgment.

— We have to announce the death of the Hon. B. B. Redding, State Fish Commissioner of California, a patron of science, and himself possessed of no small scientific attainments, who died suddenly of apoplexy at his residence in San Francisco, on the morning of August 21st. Mr. Redding was born at Yarmouth, Nova Scotia, in 1824, and was the son of the U. S. Consul at that place. In 1849, he started for California in the brig *Mary Jane*, and after some interesting experiences in the Galapagos, reached San Fran-

sisco, and proceeded to the gold mines. As a miner he was not cuccessful, but was soon elected to the Assembly, became editor of the *San Joaquin Republican*, and associate editor of the *Sacramento State Journal*, bought the latter paper; was in 1856, elected Mayor of Sacramento, and in 1863, was Secretary of State. From 1868 to his death, he was the land agent of the Central Pacific Railroad, and for several years was a Regent of the California State University.

Readers of the NATURALIST must remember his contributions to science in this Magazine, and all who knew him personally, can testify to his kindness and courtesy, as well as to his interest in everything that tended toward the development of the resources of his adopted State.

— As we go to press we are in receipt of the news of the death, on Nov. 20th, of Dr. Henry Draper, of New York, of pleurisy. Both the friends of science and the personal friends of Dr. Draper, have in his death cause of the deepest regret. Dr. Draper's devotion to science, fortunately sustained by a very helpful marriage, has been well known. His amiable character endeared him to his associates.

— The California Academy of Sciences has recently received the gift of a large collection of birds and a small number of mammals, all finely mounted specimens, including cases for the same. This present was made by Mrs. Crocker, of Sacramento, widow of the late Judge E. B. Crocker, who was much interested in natural history, especially ornithology. The collection embraces many very rare forms, and cost several thousand dollars.—*R. E. C. S.*

—Natural History is making great strides in Australia. The Biological Station at Sydney has now been completed. It is to be in part maintained by the Royal Society of New South Wales, the Royal Society of Victoria, and the Australian Biological Association. The station has been built mainly through the exertions of Baron Miclucho Maclay, the distinguished Russian naturalist and explorer.

— Professor Cope recently procured a full-grown gorilla from the Ogobai river. It was shipped in a tierce of spirits, and arrived in good order.

—Professor W. B. Carpenter lectures this winter at the Lowell Institute on Deep Sea Soundings and on Automatism in man and animals.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

PROCEEDINGS OF THE ACADEMY OF NATURAL SCIENCES, March 21.—Professor Cope characterized the *Condylarthra*, a group of Ungulates, found in the lowest horizon of the Eocene of the

United States. Having bunodont teeth, and five toes on each foot, they are the most generalized of the sub-order, but have left no unchanged descendants.

The Rev. H. C. McCook described some interesting variations in the forms of the nest of *Epeira strix*. The ordinary nest of this spider, when in open wood or field, is a rolled leaf fastened by adhesive threads. A second form consists of two leaves lashed together; a third of small holes in wood or stone, lined with web; a fourth (one example found) was a silk-lined cavity in a ball of sawdust, made by the carpenter ant; a fifth, or rather a whole series of variations was exhibited by a colony domiciled among fallen timber; a sixth form was a cavity in a bunch of parasitic moss; and a seventh is that made when the spider weaves her orb on the exposed portions of human habitations, and consists of a stiff cylinder of silk lashed strongly to the surface. This form is taken only in new buildings, which afford no crevices. In view of these adaptations to the environment, the spider must be credited with no small degree of intelligence.

March 28.—Professor H. C. Lewis gave the analysis of *Helvite* from the mica mine near Amelia Court House, Va. The result differs from the usual analysis of Helvite, which has not previously been found in America.

April 18.—Professor Kœnig described some crystals of orthite from the mica mine, at Amelia Court House, Va.

May 2.—Professor Leidy called attention to *Filaria wymani*, an entozoan that takes up its residence in the brain of the darter, *Plotus anhinga*. Professor Wyman found this worm in seventeen out of nineteen birds examined, coiled up on the back of the cerebellum between the arachnoid and pia mater, from two to eight or more in each bird. The specimen exhibited by Dr. Leidy had a single worm enclosed between the two laminæ of the dura mater in the internal of the cerebrum and cerebellum.

Numerous specimens of *Ascaris spiculigera* were also exhibited, obtained from the stomachs of *Plotus anhinga*, *Graculus dilophus*, *Pelecanus trachyrhynchus* and *P. fuscus*. Dr. Leidy exhibited a specimen of the irregular phosphatic nodules, probably coprolites of a zeuglodont or cetacean, brought from Ashley river, S. C., to be manufactured into a fertilizer; and also a quartzite water-rolled pebble with a groove round the middle like that of the stone hammers found in the ancient copper mines of Lake Superior.

Mr. Meehan gave an account of the supposed reasons why *Thuja occidentalis* gained the name of Arbor Vitæ, and suggested that the tree might be the "Annedda," a decoction of which saved the lives of Cartier's band in 1534. The Annedda is usually identified with the white spruce (*Abies alba*), from the young tops and leaves of which, according to Rafinesque, the Indians obtained a spruce beer, that was one of their famous remedies for scurvy.

BOSTON SOCIETY OF NATURAL HISTORY, Oct 4, 1882.—Mr. F. W. Putnam gave an account of recent explorations of several ancient shell heaps on the coast of Maine; and Mr. W. O. Crosby spoke of the origin and classification of joint-structures.

Oct. 18.—Dr. C. C. Abbott gave an account of his last year's researches into the history of palæolithic man in the Delaware valley; and Mr. S. Garman shows some "Antelope Medicine" of the Ogalallas.

Nov. 1.—Papers by Mr. Wm. M. Davis, on the structural value of the trap ridges of the Connecticut valley, and by Mr. W. O. Crosby, on the Elevated coral-reefs of Eastern Cuba were read. Professor Zirkel's paper on the Mineralogy of the fortieth parallel survey, postponed from the last meeting, was also read.

BIOLOGICAL SOCIETY OF WASHINGTON, Oct. 27.—Dr. W. S. Barnard made a communication on Ectoparasitic Trematodes; Mr. W. P. Conant described two cases of snake-bite in Massachusetts; and Mr. Frederick W. True spoke of the cinnamon bear, with exhibition of a specimen.

NEW YORK ACADEMY OF SCIENCES, Oct. 16.—The following papers were read: On the genesis of the Crystalline iron ores, by Dr. Alexis A. Julien; Note upon a new and remarkable Eurypterid from the Catskill group, by Professor D. S. Martin.

Oct. 23.—The following papers were read: Notes on the Cretaceous marl-belt of New Jersey, by Dr. N. L. Britton; On the origin of the crystalline ores of iron, by Professor J. S. Newberry.

APPALACHIAN MOUNTAIN CLUB, Oct. 11.—An address was delivered by Maj. Jed. Hotchkiss, of Staunton, Va., entitled "The Appalachian Mountains of the Virginias." Mr. John Ritchie, Jr., gave some notes on Mt. Stinson, Rumney, N. H.; and Mr. W. O. Crosby read notes on Elevated pot-holes near Shellburne Falls.

NATIONAL ACADEMY OF SCIENCES.—The annual autumn meeting of this body commenced in New York, at Columbia College, on Nov. 13th, and continued four days. The following is a list of the papers read:

1. Mean annual Rain-fall. Elias Loomis.
2. On white Phosphorus. Ira Remsen.
3. On the general equations of Optics, as derived from the electro-magnetic theory of Light. J. Willard Gibbs.
4. On an improved form of standard Daniell Cell. George F. Barker.
5. On complex inorganic Acids. Wolcott Gibbs.
6. On a modified form of solar Eye-piece for use with large apertures. Charles A. Young.
7. On Triassic (?) Insects from the Rocky mountains. Samuel H. Scudder.
8. Explanations on presenting a copy of the first ten numbers of the author's Celestial Charts. C. H. F. Peters.
9. Lists of Errors in Star Catalogues. C. H. F. Peters.

10. Remarks on the Structure of the present Comet. C. H. F. Peters.
11. On a method of studying the laws of Contrast quantitatively. O. N. Rood.
12. On the Heat of the Comstock lode. G. F. Becker, by invitation.
13. Topographical effects of Faults and Landslides. G. F. Becker, by invitation.
14. Prepartion of Cyanin from Chinoline. C. F. Chandler.
15. On the place of the Echeneididæ in the system. Theo. Gill.
16. On the existence in both hemispheres of a terrestrial dry zone and its cause. A. Guyot.
17. On so-called eruptive Serpentines. T. Sterry Hunt.
18. On a Sphereometer for measuring the radii of curvature of lenses of any diameter. Alfred M. Mayer.
19. On a graphical method of representing the errors of a screw. Alfred M. Mayer.
20. On a simple experimental demonstration of Ohm's law. Alfred M. Mayer.
21. On the Fauna of the Puerco Eocene. E. D. Cope.
22. On the Permian genus Diplocaulus. E. D. Cope.
23. On the physical conditions under which Coal was formed. J. S. Newberry.
24. Effect of Magnetism on chemical action. Ira Remsen.
25. On Sinapic acid. Ira Remsen.
26. On the total solar Eclipse of May 6, 1883. Charles A. Young.
27. Physical and geological character of the sea bottom off our coast, especially beneath the Gulf Stream. A. E. Verrill.
28. On the origin of the carbonaceous matter of bituminous Shales. J. S. Newberry.
29. On the meridian Photometer. E. C. Pickering.
30. On the microscopic structure of some of the Brachiopoda, with reference to their generic relation. James Hall.
31. On the logic of relations and on the determination of the figure of the earth by the variations of gravitation. C. S. Pierce.
32. On the supposed Human Footprints recently found in Nevada. O. C. Marsh.

Ontario Entomological Society.—A meeting of this society was held recently in Montreal during the session of the A. A. A. S. After the transaction of the routine business, the president, Mr. Wm. Saunders, of London, Ontario, delivered his annual address, in which he referred to the general prevalence of the Hessian fly in the province of Ontario, during the past season, inflicting a loss on the agricultural community estimated at several hundred thousand dollars, and called attention also to the relative abundance of parasites among the insects now maturing. The Phylloxera was referred to, and the discovery of the root-inhabiting type injuring the vines in several portions of the province, a form of the insect which until within the past few weeks was not known to occur within the province. Several other interesting points were taken up in reference to the occurrence of some rare insects and new habits acquired by others. The short first crop in Ontario, a result, by many, attributed to insect agency, was shown to be due to other causes, some reference was also made to the recent dissemination of insects destructive to fruit in California, and the energetic measures being adopted there to suppress them.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.—The following is a list of the papers read in the microscopical section:

SECTION G—MICROSCOPY.

On angular aperture in relation to biological investigation. Wm. B. Carpenter.

Demonstration of the Bacillus of tuberculosis. W. Osler.

The third corpuscular element in the blood. W. Osler.

The development of blood corpuscles in the bone-marrow. Wm. Osler.

Note on the Microcytes of the blood and their probable origin. W. Osler.

Plant cells and living matter. Louis Elsberg.

Histology of uterine fibroid tumors. Henry O. Marcy.

Some vegetable poisons. T. J. Burrill.

A study of the problem of fine rulings with reference to the limit of naked eye visibility and microscopic resolution. W. A. Rogers.

On a new form of dry mounting. W. A. Rogers.

The house-fly considered in connection with the distribution of infectious and contagious poisons. Thomas Taylor.

A new economic freezing microtome for section-cutting, with new mechanical devices. Thomas Taylor.

On the epidermis of Marsipobranchs. A. H. Tuttle.

Notes on some of the peculiarities incident to the diseases of fruits. D. P. Penhallow.

Notes on the present status of sanitary inspection, with special reference to the examination of water and air. Romyn Hitchcock.

A filtering wash-bottle especially adapted to the use of the histologist. C. E. Hanaman.

Development of Cilia in the p'anula of *Clava leptostyla*. J. H. Pillsbury.

AMERICAN GEOGRAPHICAL SOCIETY, Nov. 17th.—Mr. Paul B. DuChaillu delivered a lecture on his journeys in Norway, Sweden, Lapland and Northern Finland.

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THE SEVENTEENTH VOLUME OF THE AMERICAN NATURALIST.—In closing the Sixteenth volume of the AMERICAN NATURALIST, we would call the attention of our subscribers to the increased number of pages in this volume, which contains more reading matter than any previous volumes. From the papers now in hand, and those in preparation for the next year, it is believed that volume *Seventeen* will at least equal in general interest as well as in value for the special student, those of the past years.

Our thanks are due to our friends and contributors who have, by their voluntary labors, made the magazine what it is.

We would respectfully invite working naturalists to send us early notices of new discoveries as well as items of general scientific interest, and ask our friends to call the attention of all who are in any way interested in natural history to our magazine, which is designed to be an aid and stimulus in their studies and field work.

We would again ask our exchanges to specially notice the December NATURALIST, and to send marked copies containing such notices to the editors.

INDEX.

Abbot, C. C., habits of the Savannah Cricket frog, 707.
idols and idol worship of the Delaware Indians, 799.
Aboriginal implement, 203.
Achænodon insolens, 534.
Acris crepitans, 707.
Adder, blowing, 566.
puff, 566.
Æquorea forskalea, 147.
Africa, explorations in, 80, 341, 758, 1040.
Agalma, 92.
Alaska, 427.
Alaskaite, 162.
Alder catkins, 673.
Aldrich, C., birds racing with the cars, 58.
does the crow blackbird eat crayfish, 57.
feline development, 738.
how bad weather affects birds, 1010.
Algæ, 43.
Allen, T. F., American forms of Chara oosporata, 358.
Alligator, 533.
gar, 383.
Allorhina nitida, 411.
Aluminium, 837.
Alvord, B., compass plant, 625.
Amblyopsis, 2.
Amblystoma, larval, 913.
Ammonite, tertiary, 696.
Ampelita rowelli, 909.
Amphibole, 836.
Amphioxus, 313.
Anaptomorphus homunculus, 74.
Anatomical specimens, rapid preparation of, 407.
Ancistrodon, piscivorous, 564.
Anders, J. M., forests, their influence upon climate and rainfall, 19.
Animals, hypnotism in, 715.
Anisonchus coniferus, 832.
Angus, J., protective change of color in a spider, 1010.
Annedda, 1047.
Annual, 396.
Anostira ornata, 989.
Antelope, prong-horned, 407.
Anthropological nomenclature, 828.
Anthropology, 66.
in Germany, 519.
in Great Britain, 519.
Antilocapra americana, 407.
Antimony, new ore of, 608.
Ants, 804.
Anura, fossil, 979.
Aperture and power in microscopes, 1042.
Apus, 798.
Distomum in egg-sacs of, 142.
Aquacreptite, 610.
Archæan rocks of Great Britain, 74.
Archæsthetism, 454.
Arctic explorations, 839.
Argynnis myrina, 122.
Argus, 946.
Army worm, hibernation of, 516.
in 1882, 1017.
Arthromere, 676.
Arthropoda, nomenclature of parts of, 676.
Arthur, J. C., physiological value of trichomes, 132.
Asia, human races of, 1024.
Asellus communis, 241.
Asparagus stem for laboratory study, 43.
Aster, 812.
Astigmatism, 909.
Attagenus megatoma, 1019.
Aurelia aurita, 148.
Axolotl, Mexican, 913.
Ayres, W. O., ancient man of Calaveras, 845.

Bacillus, 196, 293.
Bacterium, 824.
Baena arenosa, 990.
Bænopoda, 677.
Bænosome, 677.
Bailey, W. W., note on Gerardia, 1005.
Balfour, F. M., obituary of, 843.
Barbadoes, 210.
Barber, E. A., mound pipes, 265.
Bat, fishing, 148.
Bats, teeth of, 910.
Bdelloura candida, 52,
Beal, F. E. L., nesting habits of the horned lark, 240.
Beauchamp, W. M., Bythinia tentaculata, 244.
Beauxite, 79, 527.
Bee, 680, 681, 804.
Beech, cut-leaved, 1004.
Belemnites, 2:3.
Bergamaskite, 80.
Bessey, C. E., coffee leaf fungus one of the Uredineæ, 584.
cut-leaved beech, 1004.
Bible and Science, 496.
Biblical biology, 498.
Biennial, 396.
Biology, study of, 47.
Birds, distribution of, 85.
effect of storms on, 1010.
hybridity in, 59.
limbs of, 892.
migrations of, 59.
of Heligoland, 1012.
racing with the cars, 58.
Birge, E. A., first zoea stage of Pinnotheres ostreum, 589.
Bismuth minerals, new, 80.
Bittacus apterus, 596.
Blackbird, crow, 57.
Blind cave fishes, 1.
Bombyliid larvæ, 916.
Bopyroides latreuticola, 591.
Bopyrus palæmoneticola, 6.
Boracite, 926.
Bosmina, 642.
Botanical nomenclature, 87.
Botany of Aroostook county, Me., 397.
Bot-fly maggots, 598.
Brachiopods as worms, 148.
Brain of Crustacea, 588.
Brous, H. A., habits of western snakes, 564.
Buckeye stem-borer, 913.
Bug, overflow, 681.
Butler E., an active desmid, 584.
Butterflies, habits of, 122.
Butterfly trees, 64.
Bythinia tentaculata, 244.

Call, R. E., Geographical distribution of certain mollusks, 400.
loess of North America, 369, 542.
review of Hartman on Partula, 580.
Canada, geology of, 602.
Carabidæ, 63.

Cassia chamæcrista, 281.
Cat, 35, 738.
Cathartidæ, claw on index of, 141.
Catopsalis pollux, 685.
Cave, blind fishes, 1.
Caves, 899.
Cephalopoda, American, 959, 967.
ink bag of, 820.
Cephalosome, 677.
Ceratiocaris, 945.
Cercaria, with setæ in pairs, 512.
Cercopoda, 677.
Cercospora asclepiadis, 810.
cercidicola, 810.
euonymi, 810.
malvicola, 810.
physalidis, 810.
toxicodendris, 811.
Ceresa bubalus, 822.
Cerite, 758.
Chalcid egg-parasites, 914.
Chalcis, pupation of, 63.
Chalcocite on a Roman coin, 80.
Chara, 672, 674.
coronata, 358.
Cheiroptera, 910.
Chilo oryzaëllus, 1015.
Chinch bug, 824.
Chiolite, 525.
Chirodota, viviparous, 51.
Chiton, 958.
Chlorophyll in infusoria, 1013.
Choctaws, 222.
Chodneffite, 525.
Chologaster papilliferus, 2.
Chrysocharis singularis, 61.
Chrysopa, mouth of larva of, 825.
Chukches, 612, 665.
Clam, 882.
early stages of, 911.
Claypole, E. W., defoliation of oak trees by Dryocampa senatoria in Penn., 914.
Cleistogamy in purslane, 47.
Clip, adjustible spring, 692.
Clover insects, 746.
Clover-leaf weevil, 248.
Coffee-leaf fungus, 584.
Coleoptera, wood-boring, 823.
Columbite, 611.
Comatula, 59.
Compass plant, 625.
Condenser, 169.
Congo, 528.
Cooper, W. B., is the human skull becoming thinner? 136.
Cope, E. D., Achænodon insolens, 534.
ancestry and habits of Thylacoleo, 520.
anthropomorphous lemur, 73.
Archæsthetism, 454.
use and effort, 490.
a second genus of Eocene Plagiaulacidæ, 416.
characters of Tæniodonta, 72.
Eocene Mammalia, 522.
great deposit of mud and lava, 157.
Mammalia in the Laramie formation, 830.
Marsh on the classification of the Dinosauria, 253.
Mesonyx and Oxyæna, 334.
new characters of the Perissodactyla Condylarthra, 334.
new forms of Coryphodontidæ, 73.
new forms of Tæniodonta, 831.
new genus of Tæniodonta, 604.
new genus of Tillodonta, 156.
new marsupials from the Puerco Eocene, 684.
note on bite of Heloderma, 908.
oldest Artiodactyle, 71.
Periptychidæ, 832.
Permian vertebrate, 925.
Rachitomous Stegocephali, 334.
Cope, E. D., reptiles of the American Eocene, 979.
some new forms from the Puerco Eocene, 833.
Taxeopoda, a new order of Mammalia, 522.
Tertiary formations of the central region of the U. S., 177.
two new genera of the Puerco Eocene, 417.
two new genera of Mammalia from the Wasatch Eocene, 1029.
Cortex cerebri, 742.
Coryphodon anax, 73.
Corundum, 1032.
Cosmarium botrytis, 584.
Cossyrite, 162.
Cotton fiber, 431.
worm, 327.
Coues, E., habits of English sparrow, 1009.
opossom in Central New York, 141.
sparrow pest in Australia, 140.
Crangonyx bifurcus, 145.
lucifugus, 144.
mucronatus, 241.
Crayfish, 666.
Cricket, field, grain-feeding habits of, 513.
Crocodiles, Eocene, 982.
Crocodilus acer, 982.
affinis, 984.
clavis, 985.
serratus, 986.
Crustacea, brain of, 588.
circulation in, 51.
color sense in, 244.
hair of, 244.
fresh water, 143, 813.
heterogenesis in, 813.
segmental organs of isopod, 744.
Crustacean limb, homologies of, 785.
parasitic isopod, 6.
Cryptobranchus, 816.
Cuttle-fish, 959, 967.
Cyclops agilis, 649.
insectus, 649.
thomasi, 649.
Cynipidæ, 246, 329.
Cynips, 409.
Cyrtoneura, 746.

Danais archippus, 64.
Dall, W. H., American work on recent mollusca, In 1881, 874, 953.
note on Gadinia excentrica, 737.
Daphnia magna, 814.
pulex, 815.
retrocurva, 642.
Darwin, C. R., 694.
obituary of, 487.
Darwin and anthropology, 518.
and modern botany, 507.
Dead sea, water of, 341.
Degeneration, 996.
Demodex phylloides in America, 1009.
Dermatemys wyomingensis, 991, 992.
Deserts of Africa and Asia, 1036.
Desmid, an active, 584.
Detmers, H. J., pathogenic schizophyte of hog 195, 293.
Devono-Silurian beds, 74.
Diabantite-vermiculite, 836.
Diacodexis, 1029.
Diadochite, 79.
Diamond, 336, 690.
Diamonds, artificial, 756
Diaptomus sanguineus, 647.
sicilis, 541, 645.
stagnalis, 646.
Diatomin in infusoria, 1013.
Diatrype disciformis, 238.
Diatrypella densta, 809.
Dictyocaris, 946.
Dinoderus pusillus, 747.

Dinosauria, 253, 255, 335.
Diphyes formosa, 90.
Diptera, parasitic, 411.
degeneration in, 997.
Discina solitaria, 714.
Discinocaris, 948.
Dissacus carnifex, 834.
Distomum apodis, 142.
anigenum, 149.
isostomum, 149.
Dithyrocaris, 946.
Dolium bairdii, 57.
Doryphora juncta, 678.
Draba verna, 320.
Dredging, deep sea, 149.
Drying of the earth's surface, 687.
Dryocampa senatoria, 914.
Duck, wood, 512.
Dunbar, G P., ichthyological papers, 381.
Dytiscus, 330, 600.

Ear of invertebrates, 677.
Earthworm, 741.
formation of vegetable mold by, 499.
Echidna hystrix, eggs of, 744.
Echinocaris, 952.
Echinoderms, embryology of, 1014.
Ectacodon cinctus, 73.
Ectocion, 522.
Edentata, 505.
Edwards, W. H., habits of butterflies, 122.
Eel, electric, 173.
Ellis, J. B., and G. Martin, some new species of sphæriaceous fungi, 809, 1001.
Ellis, J. B., Diatrype disciformis, 238.
new fungi, 810.
new work on the fungi, 320.
notice of Fries' fungi, 673.
Thumen's Mycotheca universal s, 321.
Embryology, 227.
Emys lativertebralis, 991, 992.
Endlich, F. M., Barbadoes, 210.
Entomostraca, 537, 640.
Eocene American reptiles, 979.
Epeira strix, 1047.
Epischura lacustris, 540, 647.
Ersbyite, 838.
Esquimaux, 567.
Estheria pulex, 754.
Eubranchipus vernalis, 242.
Eudoxia, 96.
Euphoria hirtipes, 748.
Eutænia radix, 564.
Evolution, 224, 312, 454, 470, 497.
Eye protectors, 691.

Felting caused by a beetle, 1018.
Ferns, 731.
Fewkes, J. W., Siphonophores, 89.
Fierasfer, 137.
Filaria wymani, 1047.
Fish Commission, U. S., discoveries of, 56.
fauna of Borneo, 391.
embryology of, 744, 770.
Japanese jumping, 494.
notes on, 381.
Fishes, blind cave, 1.
brain of, 60.
embryology of, 1013.
Fleas feeding on caterpillars, 826.
Flora, Cretaceous and Tertiary of the Western Territories, 102.
Florida, geology of, 256.
Fluids, preservative, 697.
staining, 772.
Fly, house, as a carrier of contagion, 1044.
Footprints, fossil, in Nevada, 821.
Forbes, S. A., Bacterium a parasite of the chinch bug, 824.
Entomostraca of Lake Michigan, 537, 640.
on blind cave fishes, 1.
Forbes, W. A., claw on index of the Cathartidæ, 141.
Forest destruction, agency of water in, 1004.
Forestry, 897.
Forests, 19.
Franz Josef Land, 838.
Frear, W., vitality of the mud puppy, 325.
Frog, cell-parasite of, 323.
Savannah cricket, 707.
Fungi, 588, 673, 809.
mimicry in, 42.
new species of American, 1001.
Furbish, Kate, botany of the "Aroostook," 391.
cut-leaved beech, 1004.

Gadinia excentrica, 737.
Galena, 338.
Galls, 246, 1018.
Gambusia patruelis, 109.
Ganoids, 228.
Gar, alligator, 383.
pike, 408.
pike, embryology of, 228.
Geese, wild, 326.
Geology, future of, 160.
Gerardia, 1005.
Gila monster, 842, 907.
Gills of lamellibranchiates, 879.
Gissler, C. F., Bopyroides latreuticola, 591.
parasitic Isopod Crustacean, 6.
parasitic worms on Limulus, 52.
Glacial marks in L brador, 30.
Glaciers, 604, 606, 694, 753.
Gold, 163.
Gonatopus pilosus, 915.
Gonopoda, 677.
Gordonia pubescens, 235.
Gramineæ, 134, 321.
Grande Eaillé, 387.
Gratacap, L. P., vitality of insects in gases, 1019.
Griffith, H. G., carnivorous habits of Microcentrus retinervis, 408.
larvæ of a fly in a hot spring in Colorado, 599.
Gymnotus, 173.

Habit and Intelligence, 125.
Hadrianus octonarius, 992.
Halbert, H. S., courtship and marriage among the Choctaws, 222.
Halipteris blakei, 55.
Haploconus entoconus, 686.
gillienus, 686.
lineatus, 417.
Harvey, F. L., habits of the woodcock, 737.
Hayden, F. V., Lesquereux on the Tertiary flora as related to Tertiary animals of the West, 602.
Hayesine, 610.
Hay, O. P., fresh-water Crustacea, 143, 241.
Heliconia charitonia, 122.
Helminthophaga leucobranchialis and lawrencii hybrids between H. pinus and chrysoptera, 59,
Heloderma, 842, 907.
Hemiganus vultuosus, 831.
Hemileia vastatrix, 584.
Hemithleus kowalevskianus, 832.
Heptodon, 1029.
Herrick, C. L., habits of fresh-water Crustacea, 813.
new genus and species of Crustacea family Lyncodaphnidæ, 1006.
Hessian fly, 1049.
Heterodon simus, 566.
Heterogenesis in Crustacea, 813.
Heterogony in Oxalis violacea, 13.
Hieratite, 423.
Hill, F. C., opossum at Elmira, N. Y., 403.
Hills, R. E., pilgrimage to Teotihuacan, 933.

Hinckley, M. H., development of the tree-toad, 636.
Hippocampus, 438.
Hippopotamus, 53.
Hog, pathogenic schizophyte of, 195, 293.
Holopedium gibberum, 641.
Horseshoe crab, parasite of, 48, 52.
Howard, L. O, chalcid pupation, 60, 149.
dorsal locomotion of Allorhina nitida, 411.
effect of pyrethrum upon the heart-beat of Plusia brassicæ, 1015.
strange habits of Metapodius femoratus, 597.
Hubbard, H. G., modes by which scale-insects spread from tree to tree, 411.
Huett, J. W., origin of prairies, 1028.
Human skull, 136.
Hyatt, A., transformations of Planorbis, etc., 441.
Hybridization in Echinoids, 677.
Hyla versicolor, 636.
Hymenocaris, 945.
Hymenorus rufipes, 748.
Hypnotism in animals, 715.
Hypogenesis in Aurelia, 148.

Ichthyology, progress of in 1880, 81.
Ichthyosaurus, 256.
Idols and idol worship of the Delawares, 799.
Imbedding in section-cuttiug, 780.
Indian languages, 749.
Infusoria 170, 763.
in dew, 59.
chlorophyll, starch and diatomin in, 1013.
Innuits, 567.
Insects and drouth, 745.
clover, 63.
fossil, 889.
fossil, of Colorado, 159.
taste in, 1019.
vitality of in gases, 1019.
Insect repellants, 596.
Isopod Crustacean, parasitic, 6.
Isosoma tritici, 247, 1017.

Japanese aquatic animals living on land, 403.
Japan, Northern, plants of, 119.
Jevons, W. S., obituary of, 843.
Jointed structure in rocks, 834.

Kangaroo, fœtal, 677.
Kansas, physical geography of, 1037.
Kidder, J. H., first insect from Wrangel island, 408.
Kieserite, 426.
Kingsley, J. S., problems for zoologists, 389.

Labrador, 930.
glacial marks in, 30.
Lake basins, 1028.
Lamprey, 227.
Laramie formation, mammalia in, 830.
Lark, horned, 240.
Leadville porphyry, 925.
Leech, aquatic, living on land, 403.
Leidy, J., memorial of, 619.
Leptodora hyalina, 641.
Lepus sylvaticus, 854, 937.
Lernilite, 690.
Lesquereux L., Cretaceous and Tertiary flora of Western Territories, 102.
Lewis, H. C., phosphorescent limestone, 687.
Lichens, 394.
Life, nature of, 509.
relation of organic compounds to, 968.
Ligyrus rugiceps, 514.
Limax, 392, 877.
Lime crystals, 77.
Limnocalanus macrurus, 646, 648.
Limulus polyphemus, 287, 436, 794.
Planarians on, 48, 52.
Linarite, 689.
Lioplax subcarinata, 737.
Lisgocaris lutheri, 754.
Litholepis spatula, 383.
Littorina littorea, 737.
Lizard, gigantic fossil land, in Australia, 605.
voice in, 678.
Lobster, limbs of, 792.
Lockington, W. N., order of the universe, 484.
progress in North American ichthyology in 1880-81, 765.
Lockwood S., gray rabbit, 854, 937.
Locust eggs, destroyed by Bombyliid larvæ, 916.
Rocky moountain, 153.
Loess, 420. 920.
of N. America, 369, 542.
Lyncodaphnia macrothroides, 1007.

Magenta; voyage of, 819.
Mammals, recent and fossil, 314.
Mammoth, Siberian, 665.
Man, ancient in California, 845.
Manatee, Steller's, 406.
Mancasellus tenax, 242.
Manganbrucite, 836.
Man, is he the highest animal? 511.
Pliocene, in America, 128.
Manteodon subquadratus, 73.
Maps, zoogeographical, 589.
Margaritana margaritifera, 401, 675.
Marks in Labrador, 30.
Martin G., and J. B. Ellis, new fungi, 809.
Martite, 526.
mountain of, 1034.
Mason, N. N., honey bee tasting of flesh, 681.
Mason, O. T., anthropological nomenclature, 828.
Mastodon, recent extinction of, 74.
Maya-Kiche, gods, 331.
Medusæ, locomotor system of, 743.
Meehan, T., motility in the flowers of Draba verna, 320.
agency of water in forest destruction, 1004.
Megapodius 727.
Megatops thrissoides, 387.
Melanerpes formicivorus, 353.
Menaccanite, 424.
Meniscœssus conquistus, 830.
Menopoma, 139, 325.
Mephitis interrupta, 736.
Mesocetus agrami, 1027.
Mesonyx ossifragus, 354.
Mesozoic of Virginia, 75.
Metagenesis in Aurelia, 148.
Metalophodon armatus, 73.
testis, 73.
Metapodius femoratus, 597.
Mexican caves with human remains, 306.
Microcentrus retinervis, 408.
Micro-chemistry, 614.
Micrococci, 437.
Micrococcus, 196, 293.
Microgaster, 679.
Microlite, 79.
Microscopic aperture, 532.
Microtome, Taylor's freezing, 1040.
Mimetite, 80.
Mimicry in fungi, 42.
Minot, C. S., is man the highest animal? 511.
Minerals, new, 340, 425, 1031.
paragenesis of, 1033.
Minnow, top, 109.
Mioclænus baldwini, 833.
brachystomus, 71.
opisthacus, 833.
protogonioides, 833.
Mistletoes, 732.
Mollusca, progress in, in 1881, 874.
distribution of, 231.

Mollusks, abyssal, 883.
geographical distribution of certain, 400, 953.
locomotion in, 740.
psychology of, 953.
Monazite, 423, 611, 927.
Monetite, 524.
Monite, 524.
Morgan, L. H., obituary of, 124.
Moroteuthis robusta, 233.
Morris, C., organic physics, 470, 549, 650.
Moths attracted by falling water, 826.
Mountain cork, 928.
Muckite, 527.
Mud lumps, 418.
puppy, 325.
Muller, H., are honey-bees carnivorous? 681.
Murtfeldt, M. E., descent of Dytiscus during a shower, 600.
Museum, National, 829.
pest, new, 826.
Mysis, 871.

Naphthaline cones, 409.
Nebalia, 794, 861, 945.
bipes, its anatomy, 861.
geoffroyi, its embryology, 870.

Nectar glands in Populus, 47.
New Guinea, mammals of, 817.
New Zealand, flora and fauna of, 421.
Nitrobarite, 78.
Nomenclator zoologicus, 898.
Notochelys costata, 524.
Nyassa, 528.

Oak, hybrid, 400.
Objectives, protector for, 618.
Ocean beds always such, 420.
Octopus, 403, 819.
Ophiuridæ, 911.
Oporornis formosa, hybridizing with H. pinus, 59.
Opossum in Central New York, 141.
Organic compounds, 968.
physics, 470, 549, 650.
Osphranticum labronectum, 645.
Oxalis violacea, heterogony in, 13.
Oxyæna, 334.
Oyster, 881, 961, 1012.

Packard, A. S. Jr., bot-fly maggots in a turtle's neck, 598.
coloring of zoo.geographical maps, 589.
glacial marks in Labrador, 30.
homologies of the Crustacean limb, 785.
Is Limulus an Arachnid? 287, 436.
Mite infesting a pork-packing house; 599.
New Distomum in egg-sacs of Apus, 141.
Nomenclature of external parts of Arthropoda, 676.
Obituary notice of C. R. Darwin, 487.
Preliminary classification of brain of Crustacea, 588.
A larval Stratiomys in a hot spring in Colorado, 590.
the Crustacean Nebalia and its fossil allies, representing the order Phyllocarida, 861.
the Paleozoic allies of Nebalia, 945.
Palæmonetis exilipes, 144.
Palæmon ohionis, 143.
Palæophis halidanus, 981.
littoralis, 981.
Palanque, age of, 412.
Palæontology, invertebrate progress of in 1881, 887.
Palmer, E., Mexican caves with human remains, 306.
Panæsthethism, 468.
Pancreatic extracts, 1011.
Pantolambda bathmodon, 418.
Paraffine, 835.
Parthenogenesis in Gastrophysa, 330.
Partula, 580.
Passer domesticus, 402.
Pecten, 607.
Peltocaris, 946.
Penguins, distribution of, 85.
Penhallow, useful plants of Northern Japan, 119.
Rabbit, gray, 854.
Perimegatoma variegatum, 826.
Periophthalmus modestus, 405.
Permian Vertebrata, 925.
Petroff J., limit of Innuit tribes on the Alaska coast, 567.
Phosphorescent limestone, 687.
Phyllocarida, 794, 797, 861, 945.
Phyllopod Crustacea, 785.
Physianthus albens, 174.
Physics, organic, 470, 549, 650.
Phytocollite, 161.
Phytonomus punctatus, 248.
Pieris menapia, 1015.
Pig, mite in skin of, 1009.
Pine, butterfly larva injurious to, 1015.
Pinnotheres ostreum, 589.
Pinus ponderosa, 353.
Pipes, mound, 265.
Plagiaulacidæ, 416, 520.
Plains, why treeless, 433.
Planaria limuli, 48.
Planarians, eye of, 53.
Planarian worms on Limulus, 48, 52.
Planorbis, 741.
transformations of, 441.
Plant growth and electric light, 46.
Plants, glands of, 88.
of Northern Japan, 119.
respiration of, 673.
Plasson, 977.
Platynus maculicollis, 681.
Plerodon spenops, 386.
Plumb, C. L., abnormal spathes of Simplocarpus, 587.
scarcity of alder catkins, 673.
Plusia brassicæ, 1015.
Poison of snakes, antidote to, 262.
Polycaon confertus, 747.
Polymastodon taoensis, 684.
Polypodium, a climbing, 736.
Porcellio, albino, 243.
Prairies, origin of, 1028.
Prawn, 868.
Prehnite, 926.
Prentiss, D. W., hypnotism in animals, 715.
Preston, H. W. botany of Mt. Mansfield and Smugglers' Notch, 901.
Prime, H., land shell new to the U. S., 909.
molluscan notes, 737.
Prodoxus decipiens, 62.
Protective coloration, 1010.
Proteoteras æsculana, 913.
claypoleana, 914.
Protogonia plicifera, 833.
Protoplasm, 976, 1013.
Pseudosymmetry, 421.
Psittacotherium multifragum, 157.
Pterodactyle, 524.
Ptilodus trouessartiensis, 686.
Pueblos, 751.
of New Mexico, 69, 70.
Puerco Eocene, fossils, 417.
Purslane, cleistogamy in, 47.
Pyrethrum, effect of on heart of moths, 1015.
Pyrgulifera, humerosa, 145.
Pyromorphite, 80.
Pyroxene, 836.

Quillworts, 506.

Rabbit, gray, 854, 937.
Ramphorhynchus phyllurus, 524.
Rattlesnake, 565, 566.
Ravenel, H. W., Gordonia pubescens, 235.
Record, Zoological, for 1880, 391.
Reptiles of the American Eocene, 979.
Rhachitomi, 333.
Rhodisite, 526
Rhytina stelleri, 406.
Rice-stalk borer, 1014.
Riley, C. V., buckeye stem borer, 913.
change of habit; two new enemies of the egg-plant, 678.
Dinoderus pusillus as a museum pest 747.
felting caused by a beetle, 1018.
habits of Coscinoptera dominicana, 598.
habits of Cybocephalus, 514.
his entomological collection, 435.
imported clover-leaf weevil, 248.
is Cystoneura a parasite or scavenger? 746.
Lichtenstein's theory as to dimorphic, asexual females, 409.
Myrmecophilous Coleoptera, 747.
new rice-stalk borer, 1014.
notes on Microgasters, 679.
oviposition of Prodoxus decipiens, 62.
possible food-plants of the cotton-worm, 327.
probable sound organs in sphingid pupæ, 745.
repelling insects by malodorants, 596.
species of Otiorhynchidæ injurious to cultivated plants, 915.
wheat-stalk worm on the Pacific coast, 1017.
Ringueberg, E. N. S., evolution of forms from the Clinton to the Niagara group, 711.
Robin, food of nestlings of, 1007.
Rogers, W. B., obituary of, 620.
Roots, fibrous, 132.
Rosterite, 79.
Ryder, J. A., Planarians parasitic on Limulus, 48, 142.
structure and ovarian incubation of Gambusia patruelis, 109.

Sahara, 258.
sand of, 527.
Saline waters, 923.
Salmon disease, 906.
Saprolegnia, 906.
Sarcode, 976.
Sarcophaga lineata, 410.
Saunders, W., mouth of larva of Chrysopa, 825.
Scale insects, 411.
Schneck, J., English sparrow, 1008.
prolific garter snake, 1008.
spotted spreading adder viviparous, 1008.
Schwann, T., obituary of, 348.
Schwarz, E. A., wood-boring Coleoptera, 823.
Secotium warneri, 323.
Section-cutting, 782.
Septoria pruni, 811.
sisymbrii, 811.
Sharks and skates, development of paired fins in, 741.
Shells, effect of gravity upon, 441, 878.
Shufeldt, R. W., bite of the Gila monster (Heloderma), 907.
number of bones at present known in the pectoral and pelvic limbs of birds, 892.
Silphium laciniatum, 625.
Silver, native, 239.
Simblum rubescens, 42.
Simonds, M. H., mud lumps and mounds near New Orleans, 418.
Siphonophores, 89.
Skull, Calaveras, 845, 995.
Skunk, 736.
Slade, E. European, house-sparrow, 402.
food of nestlings of robin, 1007.
Smaltite, 527.
Snakes, 564, 1008.
Eocene, 981.
Snake superstitions of the Pueblos, 70.
Solanum rostratum, 201.
Solidago, 812.
Sparrow, English, 140, 402, 1008, 1009.
Spathiocaris emersonii, 754.
Sphæria leucobasis, 809.
sabalicola, 810.
sabalensis, 810.
sabalensioides, 810.
Sphinx pupa, sound-organs in, 745.
Spider, protective change of color in, 1010.
Spondylus, eye of, 1012.
Sponge, 536, 623.
boring, 243.
Staining methods in microscopy, 772.
Starch in infusoria, 1013.
Starfish, how it destroys oysters, 513.
Stearns, R. E. C., acorn-storing habits of the California woodpecker, 353.
certain aboriginal implements from California, 203.
first Californian eel caught, 326
Verrillia blakei or Halipteris blakei, 55.
Steller's manatee, 406.
Sterlet, development of, 147, 1011.
Stone, calendar, of Mexico, 154.
invertebrate fossils from New Mexico, 152.
Stratiomys, 599.
Sturgeon, 739.
embryology of, 228, 1011.
Stylactis arge, 407.
Sulphur in coal, 338.
Sun spots and insect life, 598.
Swine, mite in skin of, 1009.
Symplocarpus, 587.

Tæniodonta, 831.
new genus of, 604.
Tæniolabis sulcatus, 604.
Tape worms, nervous system of, 740.
Tardigrades, revival after drying, 146.
Tariff on scientific books, 576.
Taste in insects, 1019.
Taxeopoda, 522.
Teotihuacan, 933.
Tertiary flora and fauna of the West, 602.
formations of the Central U. S., 177.
Testudinata, American Eocene, 986.
Thallophytes, systematic arrangement of, 43.
Thecla henrici, 123.
Thylacoleo, 520.
Tiger in Siberia, 175.
Tin, 757.
Titanomorphite, 424.
Toad, tree, 636.
Todd, J. E., flowers of Solanum rostratum and Cassia chamæcrista, 281.
Tourmaline, chrome, 835.
Townsend, C. H., habits of the Menopoma, 139.
Tracheata, limbs of, 789.
Tree toad, 636.
trunks, 735.
Trelease, W., heterogony in Oxalis violacea, 13.
Trichina, 678.
Trichinoscope, 429.
Trichogamma pretiosa, 914.
Trichomes, 132.
Trilobites, 40.
limbs of, 795.
Triungulin of Meloidæ, 515.

Trionyx scutum antiquum, 988.
Turdus migratorius, 1007.
Turner, H. W., albinism in a Crustacean, 243.
Turtle, longevity of, 24.
Turtles, American Eocene, 986.

Universe, order of, 484.
Uranothallite, 525.
Uranothorite, 79.
Uredineæ, 671.
heterœcism in, 1005.
Uropoda, 677.
Urosome, 677.
Use and effort, 454, 490.

Vanadian minerals, 78.
Verillia blakei, 55.
Victoria regia, 135.
Vivianite, 79.
Volcanoes, 492.

Walrus, fossil, in Maine, 326.
Ward, L. F., organic compounds in their relations to life, 968.
Wasps, 262, 804.
Webster, F. M., grain-feeding habits of field cricket, 513.
Wetherby, A. G., distribution of Margaritana margaritifera, 675.
occurrence of Mephitis interrupta in North Carolina, 736.
Whale, fossil croatian, 1027.
White, C. A., progress of invertebrate palæontology in the U. S. in 1881, 887.
Whitman, A., obituary of, 26.
Whitman, C. O., methods of microscopical research in the zoological station in Naples, 697, 772.
Wilder, B. G., habits of Cryptobranchus, 816.
Wild geese as pests, 326.
Woodcock, 737.
Woodpecker, California, acorn-storing habit, 353.
Worms, 739.
Wortman, J. L., ichthyological papers by G. P. Dunbar, with a sketch of his life, 381.
Wright, C., arrangement of fibrous roots, 132.
Wright, R. R., Demodex phylloides in America, 1009.

Zealand, New, 421.
Zones of life in the ocean, 405.
Zoo-geographical maps, 589.
Zoologists, problems for, 389.